he was told to misrepresent that fact and, thus, was forced to resign from examining those cases "for moral and ethical reasons."

As further revealed by Examiner Langel, and confirmed by two other Examiners, "allowance is not an option" in any pending BlackLight application according to official PTO policy. Under that arbitrary and capricious policy, the anonymous group of individuals, i.e. "Secret Committee," responsible for directing the named Examiner's actions in this case has knowingly violated well-established patent laws and procedures in presuming the utility of Applicant's novel hydrogen technology to be *per se* incredible as an excuse for its failure to properly consider and evaluate the scientific evidence of record amassed by Applicant at great expense. [See, e.g., MPEP § 2107, pp. 2100-31 ("A conclusion that an asserted utility is incredible can be reached only after the Office has evaluated both the assertion of the applicant regarding utility and any evidentiary basis of that assertion. The [Examiner] should be particularly careful not to start with a presumption that an asserted utility is, *per se*, "incredible" and then proceed to base a rejection under 35 U.S.C. 101 on that presumption.")]

Following Examiner Langel's resignation from examining BlackLight's cases, Applicant was informed that all of those cases would be consolidated under the authority of a new examiner, which was about the time Dr. Bernard Eng-Kie Souw first began making an appearance as the Committee's most prominent and outspoken member. Indeed, Examiner Souw has drafted numerous lengthy appendices totaling hundreds of pages and his views of Applicant's novel hydrogen technology have found their way into virtually every rejection and argument of record in all of Applicant's pending cases. Those views, however, not only lack credibility on the merits, but also, more disturbingly, reflect an extreme bias due to a genuine conflict of interest involving Dr. Souw's ownership of, and work as the lead scientist for, a competing company (BMS Enterprise) while examining Applicant's cases. Consequently, the Committee's rejections in all of BlackLight's cases, including this one, which have adopted Dr. Souw's biased and erroneous views, are fatally defective and should be immediately withdrawn to allow these cases to issue.

In furtherance of its "allowance is not an option" policy, the Committee has also manufactured new, and often conflicting, patentability standards that have been used to

improperly discount or wholly ignore Applicant's scientific data evidencing the existence of lower-energy hydrogen. For instance, the Committee has improperly imposed standards without legal basis requiring that Applicant publish his scientific evidence in peer-reviewed journal articles to establish its credibility and that Applicant's theory of operation for his novel hydrogen technology find "support [or acceptance] in the scientific community." Applicant has complied with these contrived standards by submitting over 65 technical articles evidencing the lower-energy states of hydrogen, which have been peer-reviewed by highly qualified PhD's scientists and published in esteemed scientific journals. Yet even that evidence, which the Committee has admitted is entitled to "the credibility that peer-reviewed articles have," is rejected as *per se* incredible because it supposedly "detract[s] from the central issue that the hydrino does not theoretically exist" and that "all of applicant's data cannot prove what is not theoretically possible."

Unable to cite legitimate scientific evidence to counter the extensive credible evidence published in Applicant's peer-reviewed journal articles, the Committee has adopted the fraudulent analysis published in an article by Dr. Andreas Rathke and other fictitious "evidence" in a transparent effort to elevate outdated and flawed quantum theory to the status of "physical law," to make it seem as though the existence of lower-energy hydrogen predicted by Applicant is "incredible." [See *infra.*] Even the Committee's conflicted lead Examiner, BMS President Souw, has admitted, however, that quantum theory "needs improvement" and that the existence of lower-energy hydrogen is not impossible. [*See infra; and see, e.g.,* the Committee's September 29, 2005 Office Action filed in U.S. App'n Ser. No. 09/669,877; Souw Appendix at p. 3 attached August 24, 2004 Office Action filed in U.S. App'n Ser. No. 08/467,051.] Yet, despite these and other embarrassing facts that have come to light, the Committee continues to rely upon the fraud of Dr. Rathke and the biased views of BMS President Souw to avoid fairly considering Applicant's experimental evidence that lower-energy hydrogen does in fact exist.

In view of these and other reasons to be explained, the rejection of claims 1-28 and 38-166 under 35 U.S.C. § 101 and 112, second paragraph, as lacking utility and enablement is respectfully traversed. Applicant respectfully submits that the

Committee has not met its burden of raising a *prima facie* case of inoperability for the many reasons of record and, therefore, the rejection should be withdrawn on that basis alone. Furthermore, Applicant has disclosed substantial experimental evidence in the present disclosure, prior submissions, and submissions filed herewith that fully rebut any *prima facie* case of inoperability the Committee might have raised. Applicant responds more fully to the Committee's comments, discusses the experimental evidence of record, and summarizes the improper prosecution procedures used by the Committee in the following paragraphs. For these additional reasons, the Section 101 rejection should be withdrawn.

Applicant has filed Rule 132 Declarations certifying his submitted experimental evidence, which further rebuts the Committee's unjustified utility and enablement rejections of the claimed invention. This evidence, which the Committee required Applicant to make public by submitting it to scientific journals for publication, conclusively confirms the formation of lower-energy hydrogen through practice of Applicant's novel hydrogen chemistry. To this day, the Committee has failed to properly consider the numerous Rule 132 Declarations previously filed by Applicant in violation of its own rules, as outlined in MPEP § 716:

> Evidence traversing rejections <u>must</u> be considered by the examiner whenever present. <u>All</u> entered affidavits, declarations, and other evidence traversing rejections are acknowledged and commented upon by the examiner in the next succeeding action. ... Where the evidence is insufficient to overcome the rejection, the examiner <u>must</u> specifically explain why the evidence is insufficient. General statements such "the declaration lacks technical validity" or "the evidence is not commensurate with the scope of the claims" without an explanation supporting such findings are insufficient. [Emphasis added.]

The Committee does not even mention, let alone consider, most of the certified experimental evidence identified in Applicant's Rule 132 Declarations that was submitted to overcome the rejections of record, which evidence is categorized and summarized below.

Lower-Energy Hydrogen Experimental Data

With this latest submission, Applicant now has over __100__ articles and books of record in this case, as reflected in the "List of References" set forth below. These articles detail studies that experimentally confirm a novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n = 1$) state, a chemically generated or assisted plasma (rt-plasma), and novel hydride compounds, including:

extreme ultraviolet (EUV) spectroscopy,[1]

characteristic emission from catalysis and the hydride ion products,[2]

lower-energy hydrogen emission,[3]

plasma formation,[4]

Balmer α line broadening,[5]

population inversion of hydrogen lines,[6]

elevated electron temperature,[7]

anomalous plasma afterglow duration,[8]

power generation,[9]

excessive light emission,[10] and

analysis of chemical compounds.[11]

In addition, Applicant has shown that direct plasma to electric power conversion is possible using this novel hydrogen chemistry.[12]

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[1] Ref. Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76, 78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98, 101, 104, 108-109, 110-112. A complete list of Reference Nos. is given below.

[2] Ref. Nos. 24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91, 108

[3] Ref. Nos. 14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98, 101, 104, 110-112

[4] Ref. Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93, 108-109

[5] Ref. Nos. 16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91, 92, 93, 95-97, 105, 108-109, 114

[6] Ref. Nos. 39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91

[7] Ref. Nos. 34-37, 43, 49, 63, 67, 73

[8] Ref. Nos. 12-13, 47, 81

[9] Ref. Nos. 30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98, 101, 104, 108, 110-112

[10] Ref. Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72, 109

[11] Ref. Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100, 101, 104, 108, 110-112

[12] Ref. Nos. 18, 26, 40, 48, 56, 68

A summary of Applicant's experimental data confirming the existence of lower-energy hydrogen is set forth below:

1.) the observation of intense extreme ultraviolet (EUV) emission at low temperatures (e.g. $\approx 10^3 \ K$) from atomic hydrogen and only those atomized elements or gaseous ions which provide a net enthalpy of reaction of approximately $m \cdot 27.2 \ eV$ via the ionization of t electrons to a continuum energy level where t and m are each an integer (e.g. K and Cs atoms and Rb^+ and Sr^+ ions ionize at integer multiples of the potential energy of atomic hydrogen and caused emission; whereas, the chemically similar atoms, Na, Mg, and Ba, do not ionize at integer multiples of the potential energy of atomic hydrogen and caused no emission),[13]

2.) the observation of novel EUV emission lines from microwave and glow discharges of helium with 2% hydrogen with energies of $q \cdot 13.6 \ eV$ where $q = 1,2,3,4,6,7,8,9,11,12$ or these lines inelastically scattered by helium atoms in the excitation of $He \ (1s^2)$ to $He \ (1s^1 2p^1)$ that were identified as hydrogen transitions to electronic energy levels below the "ground" state corresponding to fractional quantum numbers,[14]

3.) the observation of novel EUV emission lines from microwave and glow discharges of helium with 2% hydrogen at 44.2 nm and 40.5 nm with energies of $q \cdot 13.6 + \left(\dfrac{1}{n_f^2} - \dfrac{1}{n_i^2} \right) X 13.6 \ eV$ where $q = 2$ and $n_f = 2,4 \quad n_i = \infty$ that corresponded to multipole coupling to give two-photon emission from a continuum excited state atom and an atom undergoing fractional Rydberg state transition,[15]

4.) the identification of transitions of atomic hydrogen to lower energy levels corresponding to lower-energy hydrogen atoms in the extreme ultraviolet emission spectrum from interstellar medium and the sun,[16]

5.) the observation that the novel EUV series of lines with energies of $q \cdot 13.6 \ eV$ was observed with an Evenson microwave cell, only the peak corresponding to $q = 2$

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[13] Ref. Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93, 108-109
[14] Ref. Nos. 28, 33-36, 50, 63, 67, 71, 73, 75-76, 78, 86-87, 90
[15] Ref. Nos. 36, 71, 73
[16] Ref. Nos. 1, 5, 17, 28-29

was observed with an RF cell, and none of the peaks were observed with a glow discharge cell,[17]

6.) the observation that in a comparison of Evenson, McCarroll, cylindrical, and Beenakker microwave cavity plasmas, the novel EUV series of lines with energies of $q \cdot 13.6 \, eV$ was only observed for Evenson-cavity helium-hydrogen plasmas,[18]

7.) the EUV spectroscopic observation of lines for a hydrogen-K catalyst plasma by the Institut für Niedertemperatur-Plasmaphysik e.V. that could be assigned to transitions of atomic hydrogen to lower energy levels corresponding to fractional principal quantum numbers and the emission from the excitation of the corresponding hydride ions,[19]

8.) the recent analysis of mobility and spectroscopy data of individual electrons in liquid helium which shows direct experimental confirmation that electrons may have fractional principal quantum energy levels,[20]

9.) the observation of novel EUV emission lines from microwave discharges of argon or helium with 10% hydrogen that matched those predicted for the reaction $H(1/4) + H^+ \rightarrow H_2(1/4)^+$ having an energy spacing of 2^2 times the transition-state vibrational energy of H_2^+ with the series ending on the bond energy of $H_2(1/4)^+$,[21]

10.) the result that the novel vibrational series for the reaction $H(1/4) + H^+ \rightarrow H_2(1/4)^+$ was only observed for catalyst plasmas of helium, neon, and argon mixed with hydrogen, but not with noncatalyst xenon or krypton mixed plasmas,[22]

11.) the observation that based on the intensities of the peaks, the catalyst and the plasma source dependence of the reaction rate to form $H_2(1/4)^+$ is $Ar^+ > He^+ > Ne^+$ and microwave > glow discharge >> RF, respectively,[23]

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[17] Ref. Nos. 71, 73
[18] Ref. No. 76
[19] Ref. No. 14
[20] Ref. Nos. 17, 53
[21] Ref. Nos. 29, 70, 73, 79, 92, 93, 98, 101, 104
[22] Ref. Nos. 29, 70, 73, 79, 92, 93, 101
[23] Ref. No. 70

12.) the observation that the microwave plasma source dependence of the reaction rate to form $H_2(1/4)^+$ is Evenson microwave > McCarroll, cylindrical, Beenakker,[24]

13.) the observation of a series of vibration-rotational bands in the 60-67 nm region, a high-energy region for which vibration-rotational spectra are ordinarily unknown, emitted from low-pressure helium-hydrogen (99/1%) microwave plasmas that matched the predicted energy spacing of the vibrational energy of H_2 about the bond energy of $H_2(1/2)$ corresponding to the reaction $2H(1/2) \rightarrow H_2(1/2)$,[25]

14.) the observation of EUV plasma emission spectra in the region 60 nm to 100 nm that matched the predicted emission lines $E_{D_{H_2}}$ due to the reaction $2H(1/2) \rightarrow H_2(1/2)$ with vibronic coupling at energies of

$$E_{D+vib} = 17.913 \pm \left(\frac{\upsilon^*}{3}\right) 0.515902 \, eV$$ to longer wavelengths for $\upsilon^* = 2$ to $\upsilon^* = 32$ and to

shorter wavelengths for $\upsilon^* = 1$ to $\upsilon^* = 16$ to within the spectrometer resolution of about $\pm 0.05\%$,[26]

15.) the observation that in addition to members of the series of novel emission lines with energies of $q \cdot 13.6 \, eV$ or $E_{D+vib} = 17.913 \pm \left(\frac{\upsilon^*}{3}\right) 0.515902 \, eV$ an additional

intense peak was observed from a scaled-up Evenson cell at 41.6 nm with an energy of 29.81 eV that matched $q \cdot 13.6 \, eV$ with $q = 4$ less 24.58741 eV corresponding to inelastic scattering of these photons by helium atoms due to ionization of He to He^+,[27]

16.) the observation that in a comparison of Evenson, McCarroll, cylindrical, and Beenakker microwave cavity plasmas, the novel series of spectral lines due to the reaction $2H(1/2) \rightarrow H_2(1/2)$ with vibronic coupling at energies of

$$E_{D+vib} = 17.913 \pm \left(\frac{\upsilon^*}{3}\right) 0.515902 \, eV$$ was only observed for Evenson-cavity helium-

hydrogen and neon-hydrogen plasmas,[28]

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[24] Ref. No. 79
[25] Ref. No. 99
[26] Ref. Nos. 50, 75-76, 78, 86-87, 90
[27] Ref. No. 86
[28] Ref. No. 76

17.) the observation by gas chromatography that hydrogen was consumed by the helium-hydrogen plasmas which showed the novel EUV series of lines with energies of $q \cdot 13.6\ eV$, the novel series of spectral lines due to the reaction $2H(1/2) \rightarrow H_2(1/2)$ with vibronic coupling at energies of $E_{D+vib} = 17.913 \pm \left(\frac{\upsilon^*}{3}\right) 0.515902\ eV$, extraordinary H Balmer line broadening corresponding to $180\text{-}210\ eV$, and excess power of 21.9 W in 3 cm^3,[29]

18.) the observation of the dominant He^+ emission and an intensification of the plasma emission observed when He^+ was present with atomic hydrogen demonstrated the role of He^+ as a catalyst, [30]

19.) the observation of continuum state emission of Cs^{2+} and Ar^{2+} at 53.3 nm and 45.6 nm, respectively, with the absence of the other corresponding Rydberg series of lines from these species which confirmed the resonant nonradiative energy transfer of 27.2 eV from atomic hydrogen to the either Cs or Ar^+ catalyst,[31]

20.) the spectroscopic observation of the predicted hydride ion $H^-(1/2)$ of hydrogen catalysis by either Cs or Ar^+ catalyst at 407 nm corresponding to its predicted binding energy of 3.05 eV,[32]

21.) the observation of characteristic emission from K^{3+} which confirmed the resonant nonradiative energy transfer of $3 \cdot 27.2\ eV$ from atomic hydrogen to atomic K,[33]

22.) the spectroscopic observation of the predicted $H^-(1/4)$ ion of hydrogen catalysis by K catalyst at 110 nm corresponding to its predicted binding energy of 11.2 eV,[34]

23.) the observation of characteristic emission from Rb^{2+} which confirmed the resonant nonradiative energy transfer of 27.2 eV from atomic hydrogen to Rb^+,[35]

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[29] Ref. No. 76
[30] Ref. Nos. 36, 73
[31] Ref. Nos. 24, 39, 51, 54-55, 57, 91
[32] Ref. No. 24
[33] Ref. Nos. 27, 39, 42, 46, 51, 54-55, 57, 81, 89, 91
[34] Ref. Nos. 81, 42, 27

24.) the spectroscopic observation of the predicted $H^-(1/2)$ ion of hydrogen catalysis by Rb^+ catalyst at 407 nm corresponding to its predicted binding energy of $3.05\ eV$,[36]

25.) the observation of $H^-(1/2)$, the hydride ion catalyst product of K^+/K^+ or Rb^+, at its predicted binding energy of $3.0468\ eV$ by high resolution visible spectroscopy as a continuum threshold at 4068.2 Å and a series of structured peaks separated from the binding energy by an integer multiple of the fine structure of $H(1/2)$ starting at 4071 Å that matched predicted free-free transitions,[37]

26.) the observation that the high resolution visible K^+/K^+ or Rb^+-H_2 plasma emission spectra in the region of 3995 to 4060 Å matched the predicted bound-free hyperfine structure lines E_{HF} of $H^-(1/2)$ calculated from the electron g factor as $E_{HF} = j^2 3.00213\ X\ 10^{-5} + 3.0563\ eV$ (j is an integer) for $j=1$ to $j=39$ (3.0563 eV to 3.1012 eV—the hydride binding energy peak plus one and five times the spin-pairing energy, respectively) to within a 1 part per 10^4,[38]

27.) Rb^+ or $2K^+$ catalysts formed a plasma having strong VUV emission with a stationary inverted Lyman population with an overpopulation sufficient for lasing, and emission from $H^-(1/2)$ was observed at 4071 Å corresponding to its predicted binding energy of $3.0468\ eV$ with the fine structure and its predicted bound-free hyperfine structure lines $E_{HF} = j^2 3.00213\ X\ 10^{-5} + 3.0563\ eV$ (j is an integer) that matched for $j=1$ to $j=37$ to within a 1 part per 10^4,[39]

28.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing at wavelengths over a wide range from micron to blue wherein molecular oxygen served as the catalyst as supported by O^{2+} emission and H Balmer line broadening of 55 eV compared to 1 eV for hydrogen alone,[40]

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[35] Ref. Nos. 32, 39, 42, 46, 51, 54-55, 57, 81, 89, 91
[36] Ref. No. 32
[37] Ref. Nos. 39, 42, 46, 57, 81, 89, 91
[38] Ref. Nos. 39, 42, 46, 57, 81, 89, 91
[39] Ref. Nos. 39, 42, 46, 51, 54, 55, 57, 81, 89, 91
[40] Ref. Nos. 59, 65-66, 68, 74, 83, 85

29.) the observation of H Balmer line broadening of 55 eV compared to 1 eV for hydrogen alone at distances up to 5 cm from the coupler,[41]

30.) the observation that with a microwave input power of 9 $W \cdot cm^{-3}$, a collisional radiative model showed that the hydrogen excited state population distribution was consistent with an $n = 1 \rightarrow 5,6$ pumping power of an unprecedented 200 $W \cdot cm^{-3}$ permissive of gas laser efficiencies orders of magnitude those of conventional visible gas lasers and direct generation of electrical power using photovoltaic conversion of the spontaneous or stimulated water vapor plasma emission,[42]

31.) the observation of stimulation of the stationary inverted H Balmer population from a low pressure water-vapor microwave discharge plasma by back illumination with an infrared source that showed depopulation of the $n = 5$ state,[43]

32.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing was observed for Evenson microwave plasmas, but not for RF or discharge plasmas,[44]

33.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing that was dependent on the microwave plasma source with the highest inversion from Evenson microwave plasmas,[45]

34.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing that was dependent on the pressure of the Evenson microwave plasma,[46]

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[41] Ref. No. 74
[42] Ref. Nos. 68, 83, 85
[43] Ref. Nos. 59, 65, 68, 85
[44] Ref. Nos. 59, 65-66, 68, 73, 83, 85
[45] Ref. No. 83
[46] Ref. Nos. 59, 68, 73, 83, 85

35.) the observation of stationary inverted H Balmer populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing at distances up to 5 cm from the coupler,[47]

36.) the observation that the requirement for the natural hydrogen-oxygen stoichiometry of the Evenson water plasma was stringent in that a deviation by over 2% excess of either gas caused a reversal of the H inversion in water vapor plasmas,[48]

37.) the observation of a typical slow H population for a water-vapor plasma maintained in a GEC-type cell that was independent of time, and a new phenomenon, an extraordinary fast population that increased from zero to a significant portion of the Balmer α emission with time under no-flow conditions wherein the peak width and energy increased with time up to a 0.7 nm half-width corresponding to an average hydrogen atom energy of 200 eV,[49]

38.) the observation of a substantial fast H population (~20% at 40 eV) for a water-vapor plasmas maintained in a GEC-type cell that was independent of position including regions were the electric field was orders of magnitude to low to explain the extraordinarily high Doppler energies,[50]

39.) the observation of fast H population (40-50 eV) for He / H_2 (95/5%), Ar / H_2 (95/5%), and H_2 plasmas maintained in a GEC-type cell that was independent of position including regions were the electric field was orders of magnitude to low to explain the extraordinarily high Doppler energies,[51]

40.) the observation of the features of excessive H broadening that can not be explained by field-acceleration models such as an isotropic effect (broadening is independent of position in the cell or observation direction relative to the applied-field direction, selective H broadening, lack of a requirement for a divertor or reflector, time dependence, lack of an applied-field or pressure dependence over a broad range, and

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[47] Ref. No. 74
[48] Ref. Nos. 59, 68, 83, 85
[49] Ref. No. 95
[50] Ref. No. 96
[51] Ref. Nos. 92, 93, 97, 105

the observation that only particular hydrogen-mixed plasmas show the extraordinary broadening,[52]

41.) the observation by the Institut für Niedertemperatur-Plasmaphysik e.V. of an anomalous plasma and plasma afterglow duration formed with hydrogen-potassium mixtures,[53]

42.) the observation of anomalous afterglow durations of plasmas formed by catalysts providing a net enthalpy of reaction within thermal energies of $m \cdot 27.28 \ eV$,[54]

43.) the formation of a chemically generated hydrogen plasma with the observation of Lyman series in the EUV that represents an energy release about 10 times that of hydrogen combustion which is greater than that of any possible known chemical reaction,[55]

44.) the observation of line emission by the Institut für Niedertemperatur-Plasmaphysik e.V. with a 4° grazing incidence EUV spectrometer that was 100 times more energetic than the combustion of hydrogen,[56]

45.) the excessive increase in the Lyman emission upon the addition of helium or argon catalyst to a hydrogen plasma,[57]

46.) the observation of the characteristic emission from Sr^+ and Sr^{3+} that confirmed the resonant nonradiative energy transfer of $2 \cdot 27.2 \ eV$ from atomic hydrogen to Sr^+,[58]

47.) the observation of anomalous plasmas formed with Sr and Ar^+ catalysts at 1% of the theoretical or prior known voltage requirement with a light output per unit power input up to 8600 times that of the control standard light source,[59]

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[52] Ref. No. 114
[53] Ref. Nos. 13, 47, 81
[54] Ref. Nos. 12, 13, 47, 81
[55] Ref. Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91, 109
[56] Ref. No. 14
[57] Ref. Nos. 20, 31, 37, 43
[58] Ref. Nos. 16, 52
[59] Ref. Nos. 11, 16, 20, 23, 52, 72

48.) the observation that the optically measured output power of gas cells for power supplied to the glow discharge increased by over two orders of magnitude depending on the presence of less than 1% partial pressure of certain catalysts in hydrogen gas or argon-hydrogen gas mixtures, and an excess thermal balance of 42 W was measured for the 97% argon and 3% hydrogen mixture versus argon plasma alone,[60]

49.) the observation that glow discharge plasmas of the catalyst-hydrogen mixtures of strontium-hydrogen, helium-hydrogen, argon-hydrogen, strontium-helium-hydrogen, and strontium-argon-hydrogen showed significant Balmer α line broadening corresponding to an average hydrogen atom temperature of $25 - 45\ eV$; whereas, plasmas of the noncatalyst-hydrogen mixtures of pure hydrogen, krypton-hydrogen, xenon-hydrogen, and magnesium-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of $\approx 3\ eV$,[61]

50.) the observation that microwave helium-hydrogen and argon-hydrogen plasmas having catalyst Ar^+ or He^+ showed extraordinary Balmer α line broadening due to hydrogen catalysis corresponding to an average hydrogen atom temperature of $110 - 130\ eV$ and $180 - 210\ eV$, respectively; whereas, plasmas of pure hydrogen, neon-hydrogen, krypton-hydrogen, and xenon-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of $\approx 3\ eV$,[62]

51.) the observation that microwave helium-hydrogen and argon-hydrogen plasmas showed average electron temperatures that were high, $30,500 \pm 5\%\ K$ and $13,700 \pm 5\%\ K$, respectively; whereas, the corresponding temperatures of helium and argon alone were only $7400 \pm 5\%\ K$ and $5700 \pm 5\%\ K$, respectively,[63]

52.) the observation of significant Balmer α line broadening of $17, 9, 11, 14,$ and $24\ eV$ from rt-plasmas of incandescently heated hydrogen with K^+ / K^+, Rb^+, cesium, strontium, and strontium with Ar^+ catalysts, respectively, wherein the results could not be explained by Stark or thermal broadening or electric field

[60] Ref. No. 22
[61] Ref. Nos. 16, 20, 30, 52, 72
[62] Ref. Nos. 33-37, 43, 49, 60, 63-64, 69, 71, 73-74, 82, 84, 88
[63] Ref. Nos. 34-37, 43, 49, 63, 67, 73

acceleration of charged species since the measured field of the incandescent heater was extremely weak, 1 V/cm, corresponding to a broadening of much less than 1 eV,[64]

53.) calorimetric measurement of excess power of 20 mW/cc on rt-plasmas formed by heating hydrogen with K^+ / K^+ and Ar^+ as catalysts,[65]

54.) the observation of an energy balance of $\Delta H = -17,925\ kcal / mole\ KNO_3$, about 300 times that expected for the most energetic known chemistry of KNO_3, and $-3585\ kcal / mole\ H_2$, over 60 times the hypothetical maximum enthalpy of $-57.8\ kcal / mole\ H_2$ due to combustion of hydrogen with atmospheric oxygen, assuming the maximum possible H_2 inventory when KNO_3 and Raney nickel were used as a source of K catalyst and atomic hydrogen, respectively, to produce the corresponding exothermic reaction,[66]

55.) the observation of rt-plasmas formed with strontium and argon at 1% of the theoretical or prior known voltage requirement with a light output per unit power input up to 8600 times that of the control standard light source as well as an excess power of 20 mW/cm from rt-plasmas formed by Ar^+ as the catalyst in an incandescent-filament cell,[67]

56.) the Calvet calorimetry measurement of an energy balance of over $-151,000\ kJ / mole\ H_2$ with the addition of 3% hydrogen to a plasma of argon having the catalyst Ar^+ compared to the enthalpy of combustion of hydrogen of $-241.8\ kJ / mole\ H_2$; whereas, under identical conditions no change in the Calvet voltage was observed when hydrogen was added to a plasma of noncatalyst xenon,[68]

57.) the observation that the power output exceeded the power supplied to hydrogen glow discharge plasmas by 35-184 W depending on the presence of catalysts from helium or argon and less than 1% partial pressure of strontium metal in noble gas-

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[64] Ref. Nos. 39, 42, 46, 51-52, 54-55, 57, 72, 81, 89, 91, 108-109
[65] Ref. Nos. 39, 81, 89, 108
[66] Ref. No. 111
[67] Ref. Nos. 72, 109
[68] Ref. No. 31

hydrogen mixtures; whereas, the chemically similar noncatalyst krypton had no effect on the power balance,[69]

58.) the observation that with the addition of 3% flowing hydrogen to an argon microwave plasma with a constant input power of 40 W, the gas temperature increased from 400°C to over 750°C; whereas, the 400°C temperature of a xenon plasma run under identical conditions was essentially unchanged with the addition of hydrogen,[70]

59.) observations of power such as that where the addition of 10% hydrogen to a helium microwave plasma maintained with a constant microwave input power of 40 W, the thermal output power was measured to be at least 280 W corresponding to a reactor temperature rise from room temperature to 1200°C within 150 seconds, a power density of 28 MW/m^3, and an energy balance of at least $-4 \, X10^5 \, kJ/mole \, H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8 \, kJ/mole \, H_2$,[71]

60.) the observation of $306 \pm 5 \, W$ of excess power generated in 45 cm^3 by a compound-hollow-cathode-glow discharge of a neon-hydrogen (99.5/0.5%) mixture corresponding to a power density of 6.8 MW/m^3 and an energy balance of at least $-1 \, X10^6 \, kJ/mole \, H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8 \, kJ/mole \, H_2$,[72]

61.) the observation that for an input of 37.7 W, the total plasma power of the neon-hydrogen plasma measured by water bath calorimetry was 60.7 W corresponding to 23.0 W of excess power in 3 cm^3,[73]

62.) the observation of intense He^+ emission and a total plasma power of a helium-hydrogen plasma measured by water bath calorimetry of 30.0 W for an input of 8.1 W, corresponding to 21.9 W of excess power in 3 cm^3 wherein the excess power density and energy balance were high, 7.3 W/cm^3 and $-2.9 \, X10^4 \, kJ/mole \, H_2$, respectively,[74]

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[69] Ref. No. 30
[70] Ref. No. 43
[71] Ref. Nos. 34, 35
[72] Ref. Nos. 50, 78
[73] Ref. No. 76
[74] Ref. Nos. 36, 63, 71, 73

63.) in the comparison of helium-hydrogen plasmas sources, the observation that
i.) with an input power of 24.8± 1 W, the total plasma power of the Evenson microwave
helium-hydrogen plasma measured by water bath calorimetry was 49.1 ± 1 W
corresponding to 24.3 ± 1 W of excess power in 3 cm^3 corresponding to a high excess
power density and energy balance of 8.1 W/cm^3 and over $-3 \times 10^4 \ kJ/mole \ H_2$,
respectively, ii.) with an input of 500 W, a total power of 623 W was generated in a 45
cm^3 compound-hollow-cathode-glow discharge, iii.) less than 10% excess power was
observed from inductively coupled RF helium-hydrogen plasmas, and iv.) no
measurable heat was observed from MKS/Astex microwave helium-hydrogen plasmas
that corresponded to the absence of H Balmer line broadening, [75]

64.) the observation of energy balances of helium-hydrogen microwave plasmas
of over 100 times the combustion of hydrogen and power densities greater than
10 W/cm^3 measured by water bath calorimetry,[76]

65.) at the load matching condition of 600 Ω, the direct plasmadynamic
conversion (PDC) of open circuit voltages of 11.5 V and ~200 mW of electrical power
with a 0.125 in diameter by 3/4 in long plasmadynamic electrode and a 140 G applied
field corresponding to an extracted power density of ~1.61 W/cm^3 and an efficiency of
~18.8%,[77]

66.) at the load matching condition of 250 Ω, the direct plasmadynamic
conversion (PDC) of open circuit voltages of 21.8 V and 1.87 W of electrical power with
a 0.125 in diameter by 3/4 in long plasmadynamic electrode and a 140 G applied field
corresponding to an extracted power density of 3.6 W/cm^3 and an efficiency of 42%,[78]

67.) the projection that the generation of electricity using magnetohydrodynamic
(MHD) conversion of the plasma particle energy of small to mid-size chemically assisted
microwave or glow discharge plasma (ca-plasma) power sources in the range of a few

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[75] Ref. Nos. 84, 98, 104
[76] Ref. Nos. 34-36, 50, 63, 71, 73, 76-78, 84, 92, 93, 101, 112
[77] Ref. No. 48
[78] Ref. No. 56

hundred Watts to several 10's of kW for microdistributed commercial applications appears feasible at 50% efficiency or better with a simple compact design,[79]

68.) the differential scanning calorimetry (DSC) measurement of minimum heats of formation of KHI by the catalytic reaction of K with atomic hydrogen and KI that were over $-2000\ kJ/mole\ H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8\ kJ/mole\ H_2$,[80]

69.) the isolation of novel hydrogen compounds as products of the reaction of atomic hydrogen with atoms and ions which formed an anomalous plasma as reported in the EUV studies,[81]

70.) the synthesis and identification of a novel diamond-like carbon film terminated with $CH(1/p)$ (H^*DLC) comprising high binding energy hydride ions was synthesized for the first time from solid carbon by a microwave plasma reaction of a mixture of 10-30% hydrogen and 90-70% helium wherein He^+ served as a catalyst with atomic hydrogen to form the highly stable hydride ions and an energetic plasma,[82]

71.) the synthesis of polycrystalline diamond films on silicon substrates without diamond seeding by a very low power microwave plasma reaction of a mixture of helium-hydrogen-methane (48.2/48.2/3.6%) wherein He^+ served as a catalyst with atomic hydrogen to form an energetic plasma with an average hydrogen atom temperature of $180-210\ eV$ versus $\approx 3\ eV$ for pure hydrogen and bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond,[83]

72.) the synthesis of polycrystalline diamond films on silicon substrates without diamond seeding by a very low power microwave plasma reaction of a mixture of argon-hydrogen-methane (17.5/80/2.5%) wherein Ar^+ served as a catalyst with atomic hydrogen to form an energetic plasma with an average hydrogen atom temperature of $110-130\ eV$ versus $\approx 3\ eV$ for pure hydrogen and bombardment of the carbon surface

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[79] Ref. No. 40
[80] Ref. No. 25
[81] Ref. Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 75, 81, 87, 90, 92, 93, 100, 101, 108, 110-112
[82] Ref. No. 60
[83] Ref. Nos. 64, 69, 88

by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond,[84]

73.) the identification of a novel highly stable surface coating $SiH(1/p)$ by time of flight secondary ion mass spectroscopy that showed SiH^+ in the positive spectrum and H^- dominant in the negative spectrum and by X-ray photoelectron spectroscopy which showed that the H content of the SiH coatings was hydride ions, $H^-(1/4)$, $H^-(1/9)$, and $H^-(1/11)$ corresponding to peaks at 11, 43, and 55 eV, respectively, and showed that the surface was remarkably stable to air,[85]

74.) the isolation of novel inorganic hydride compounds such as $KH\,KHCO_3$ and KH following each of the electrolysis and plasma electrolysis of a K_2CO_3 electrolyte which comprised high binding energy hydride ions that were stable in water with their identification by methods such as (i) ToF-SIMS on $KH\,KHCO_3$ which showed inorganic hydride clusters $K[KH\,KHCO_3]_t^-$ and a negative ToF-SIMS dominated by hydride ion, (ii) X-ray photoelectron spectroscopy which showed novel peaks corresponding to high binding energy hydride ions, and (iii) ^1H nuclear magnetic resonance spectroscopy which showed upfield shifted peaks corresponding to more diamagnetic, high-binding-energy hydride ions,[86]

75.) the identification of $LiHCl$ comprising a high binding energy hydride ion by time of flight secondary ion mass spectroscopy which showed a dominant H^- in the negative ion spectrum, X-ray photoelectron spectroscopy which showed $H^-(1/4)$ as a new peak at its predicted binding energy of 11 eV, ^1H nuclear magnetic resonance spectroscopy which showed an extraordinary upfield shifted peak of -15.4 ppm corresponding to the novel hydride ion, and powder X-ray diffraction which showed novel peaks,[87]

76.) the identification of novel hydride compounds by a number of analytical methods such as (i) time of flight secondary ion mass spectroscopy which showed a dominant hydride ion in the negative ion spectrum, (ii) X-ray photoelectron spectroscopy which showed novel hydride peaks and significant shifts of the core levels of the primary

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elements bound to the novel hydride ions, (iii) ^1H nuclear magnetic resonance spectroscopy (NMR) which showed extraordinary upfield chemical shifts compared to the NMR of the corresponding ordinary hydrides, and (iv) thermal decomposition with analysis by gas chromatography, and mass spectroscopy which identified the compounds as hydrides,[88]

77.) the NMR identification of novel hydride compounds MH^*X wherein M is the alkali or alkaline earth metal, X, is a halide, and H^* comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance,[89]

78.) the replication of the NMR results of the identification of novel hydride compounds by large distinct upfield resonances at Spectral Data Services, University of Massachusetts Amherst, University of Delaware, Grace Davison, and National Research Council of Canada,[90]

79.) the NMR identification of novel hydride compounds MH^* and MH_2^* wherein M is the alkali or alkaline earth metal and H^* comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance that proves the hydride ion is different from the hydride ion of the corresponding known compound of the same composition, [91]

80.) the observation that the ^1H MAS NMR spectrum of novel compound KH^*Cl relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of $p = 4$, and the novel peak of KH^*I at -1.5 ppm relative to TMS corresponding to an absolute resonance shift of -33.0 ppm matched the theoretical prediction of $p = 2$,[92]

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[88] Ref. Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 75, 81, 87, 90, 92, 93, 100, 108, 110-112
[89] Ref. Nos. 10, 19, 41, 44, 62, 81, 108, 110-112
[90] Ref. Nos. 19, 81, 108, 110
[91] Ref. Nos. 19, 81, 108, 110-112
[92] Ref. Nos. 81, 108, 110-112

81.) the observation that the predicted catalyst reactions, position of the upfield-shifted NMR peaks, and spectroscopic data for $H^-(1/2)$ and $H^-(1/4)$ were found to be in agreement,[93]

82.) the analysis by Infrared (FTIR) spectroscopy which eliminated any known explanation such as U centered H for the assignment of the extraordinary upfield-shifted NMR peak.[94]

83.) the isolation of fraction-principal-quantum-level molecular hydrogen $H_2(1/p)$ gas by liquefaction using an ultrahigh-vacuum, liquid nitrogen cryotrap, and the observations of novel peaks by cryogenic gas chromatography, a higher ionization energy than H_2 by mass spectroscopy, a substantial change in the EUV emission spectrum with deuterium substitution in a region where no hydrogen emission has ever been observed, and upfield shifted NMR peaks at 0.21, 2.18 and 3.47 ppm compared to that of H_2 at 4.63 ppm,[95]

84.) the observation of ^1H NMR singlet peaks upfield of H_2 with a predicted integer spacing of 0.64 ppm at 3.47, 3.02, 2.18, 1.25, 0.85, and 0.22 ppm identified as the consecutive series $H_2(1/2)$, $H_2(1/3)$, $H_2(1/4)$, $H_2(1/5)$, $H_2(1/6)$, and $H_2(1/7)$, respectively, and $H_2(1/10)$ at -1.8 ppm wherein $H_2(1/p)$ gas was isolated by liquefaction at liquid nitrogen temperature, by decomposition of compounds found to contain the corresponding hydride ions $H^-(1/p)$, and by permeation through a hollow nickel cathode,[96]

85.) the observation of excess enthalpy from a K_2CO_3 electrolytic cell of a factor of two times that of the resistive power dissipation and ^1H NMR singlet peaks upfield of H_2 with a predicted integer spacing of 0.64 ppm at 3.49, 2.17, 1.25, 0.86, and 0.21 ppm which matched the consecutive series $H_2(1/2)$, $H_2(1/4)$, $H_2(1/5)$, $H_2(1/6)$, and $H_2(1/7)$, respectively, and a higher ionizing molecular hydrogen recorded on the electrolysis gases collected in a hollow nickel cathode,[97]

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[93] Ref. Nos. 81, 108, 110-112
[94] Ref. Nos. 108, 110-112
[95] Ref. Nos. 75, 87, 90, 92, 93, 94, 101, 112
[96] Ref. Nos. 98, 101, 103-104, 112
[97] Ref. Nos. 103-104

86.) the observation of 1943 cm^{-1} and 2012 cm^{-1} peaks in the high-resolution (0.5 cm^{-1}) FTIR spectrum (490-4000 cm^{-1}) of $KH*I$ having a peak assigned to $H^-(1/4)$ that matched the predicted frequencies of ortho and para- $H_2(1/4)$,[98]

87.) the observation of the 1943/2012 cm^{-1}-peak-intensity ratio of 3:1 in the high resolution (0.5 cm^{-1}) FTIR spectrum (1875-2060 cm^{-1}) of $KH*I$ which is characteristic of ortho-para hydrogen splitting wherein the ortho-para splitting of 69 cm^{-1} matched that predicted,[99]

88.) the observation of rotational lines in the 145-300 nm region from atmospheric pressure 12.5 keV electron-beam excited argon-hydrogen plasmas where the unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)$,[100]

89.) the observation of emission from 12.5 keV-electron-beam-excited $KH*Cl$ having $H^-(1/4)$ by NMR that matched the rotational emission lines of interstitial $H_2(1/4)$ and further matched the rotational frequency of $H_2(1/4)$ observed by FTIR and by electron-beam excitation of the argon-hydrogen plasmas.[101]

The dismissal of this extensive body of experimental evidence by the Secret Committee, led by Dr. Souw, is a major disappoint, not only for its failure to fairly evaluate this evidence of lower energy states, but also for its incredible lack of understanding of the nature of Applicant's invention as it relates to the most basic scientific principles. Applicant had expected that Dr. Souw, as the founder and current president of BMS Enterprise—a company that competes in some of the same scientific fields as Applicant—would have a better grasp of the concepts underlying the technology he is examining. Or it could just be that Dr. Souw is unable to put his conflicting business interests aside and fairly evaluate a competitor's invention, along with the supporting evidence submitted therewith.

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[98] Ref. Nos. 110-112
[99] Ref. Nos. 110-112
[100] Ref. Nos. 98, 101, 104, 110-112
[101] Ref. Nos. 111-112

In either case, the erroneous arguments that populate Dr. Souw's various Office Actions and Appendices, particularly those in defense of outdated quantum theory, are untenable. Particularly disturbing is the fact that the Committee in this case has elevated Dr. Souw's distorted views of that seriously flawed theory, one that he readily admits "needs improvement," into the category of an accepted "scientific principle" upon which Applicant's invention and supporting experimental evidence is falsely proclaimed to be "incredible." This fundamental error permeates the Committee's entire analysis, which has resulted in the misguided rejections of Applicant's claims for allegedly failing to comply with the utility and enablement requirements of 35 U.S.C. §§ 101 and 112, first paragraph, respectively.

With now over 65 peer-reviewed articles in esteemed scientific journals evidencing the existence of lower energy states, along with other countless evidence, Applicant's modern quantum theory has now gained acceptance in the scientific community in accordance with one of the many new standards created by the Committee for this one Applicant. [*See infra.*] The Committee's refusal to grant Applicant a fair and expeditious hearing on that evidence, led by BMS President Souw, is a "black eye" to an agency charged with the public trust to impartially carry out its constitutional directive of promoting the progress of science.

Applicant again respectfully demands that the Committee consider and evaluate in detail all of the record evidence, which, to date, it has largely ignored. The scientific data disclosed in this extensive body of evidence was collected and peer-reviewed with great care by a group of highly qualified scientists capable of understanding every detail of Applicant's technology. The very least the Committee can do is to also carefully evaluate that data in detail, article by article, with an open mind so that Applicant is given a full and fair opportunity to present his case. If and when the Committee finally does so, Applicant believes it will find that the evidence overwhelmingly proves the existence of lower-energy hydrogen in accordance with his disclosed invention.

If, on the other hand, the Committee should find true fault with any of that data on legitimate scientific grounds—not the kind of nitpicking Applicant has seen on theoretical grounds—it should communicate as much to afford Applicant the opportunity

to respond. Such scientific give-and-take is the only way to advance the prosecution of this case.

Unfortunately, with continued prosecution of this and BlackLight's other applications, a far different pattern has emerged. The Committee continues to set arbitrary and capricious hurdles designed to avoid considering Applicant's conclusive experimental evidence and thereby block his patents from issuing. Each time Applicant clears one of these hurdles, the Committee merely raises the bar by setting new standards.

For instance, the Committee initially alleged that Applicant's disclosed hydrogen chemistry, which forms lower-energy hydrogen, related to the controversial concepts of "perpetual motion" and "cold fusion." When Applicant exposed those allegations as utter nonsense, the Committee quickly abandoned its indefensible position, arguing instead that BlackLight's lower-energy hydrogen technology violated unidentified laws of physics. Then, to cover up its failure to identify even a single physical law that was supposedly being violated, the Committee improperly placed the burden on Applicant to do so: "in order to establish enablement, applicant bears the burden of providing the accepted scientific laws wrong or incomplete." [See page 6 of Office Action dated July 16, 2001 in U.S. App'n Ser. No. 08/467,911.] When Applicant showed that just the opposite is true—that Applicant's novel hydrogen chemistry complies with all physical laws, even at atomic and sub-atomic levels—the Committee once again backpedaled.[102]

The Committee then advanced vague assertions that the concept of lower-energy hydrogen violated "ideas" of modern science and that this technology contradicted "beliefs" in the scientific community. These assertions later evolved into a new standard requiring Applicant to show that his theory of operation has "support [or acceptance] in the scientific community." See, for example, the August 25, 2005 Office Action issued in U.S. App'n Ser. No. 09/181,180:

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[102] The Committee later resurrected this abandoned argument in a last-ditch effort to brand Applicant's lower-energy hydrogen technology a scientific impossibility, relying on an internet posting to claim that the ground state of an electron is a basic physical law that cannot be violated. As Applicant shows herein below, that argument is also wholly without merit and, in fact, contradicts even the biased views of Examiner/BMS President Souw, who was assigned to oversee examination of all of Applicant's cases based on his alleged technical expertise. [See infra.]

> The claims are directed to [a] device for generating heat based upon hydrogen catalysis. In this device a source of hydrogen and a vapor catalysis are sent to a reaction chamber wherein heat is generated because, by applicant's theory, the energy level of atomic hydrogen is reduced from the stable level of N=1 to lower levels such as N=½ , ¼ etc to form atoms known as "hydrinos". In this reduction, large amounts of energy are said to be produced. The examiner considers that this description would not enable the skilled artisan to make and use the invention. In the first place, there is <u>no support in the scientific community</u> for applicant's theory of operation.
>
> * * *
>
> Applicant's arguments filed May 25, 2005 have been fully considered but they are not persuasive. Applicant has submitted many non-patent literature documents in the IDS filed 5/25/05, but it is not clear which if any of these documents indicate that the theory upon [which] applicant's invention is based has been <u>accepted in the scientific community</u>. [Office Action at 2-3 (emphasis added).]

This standard, like so many others promoted by the Committee in this case, is erroneous and should be withdrawn for two reasons: first, the level of support (or acceptance) in the scientific community is not the proper standard for ascertaining whether an applicant has satisfied the enablement or utitlity requirements under Sections 112 and 101, respectively; and second, even under that erroneous standard, Applicant has clearly met it by showing that his claimed invention <u>does</u> have support in the scientific community.

Regarding the Committee's misplaced reliance on its newly minted "support in the scientific community" standard to deny Applicant patent protection for his pioneering technology, that standard makes absolutely no sense and thus, not surprisingly, has no legal basis. Until recent rule changes, the PTO kept patent applications in strict confidence. Typically, an invention disclosure would be made public only after claims were found to be allowable, whereupon the application would then be published as an issued patent. So it defies common sense to claim that applicants are required to show that their inventions have support in the scientific community, when there was no requirement until recently that a patent applicant even disclose his invention to the public until such time as a patent issues.

The irony here is that, according to the Committee's nonsensical standard, the more pioneering the invention, the more difficult it will necessarily be to show "support in the scientific community." Yet these pioneering inventions are the ones most deserving of patent protection.

This requirement that Applicant show support in the scientific community was no doubt the motivation behind the Committee's demand that Applicant publish his scientific evidence of lower energy states of hydrogen in peer-reviewed journal articles. Despite the Committee's failure to cite any legal authority for that evidentiary standard, Applicant nonetheless complied with it. As previously stated, Applicant now has over <u>65</u> peer-reviewed articles published in respected scientific journals regarding the operation of his lower-energy hydrogen technology, thus demonstrating considerable support in the scientific community.[103] Thus, by the Committee's own admission, this accomplishment establishes Applicant's satisfaction of the enablement and utility requirements under 35 U.S.C. §§ 112 and 101.

Indeed, the Committee initially touted the credibility of peer-reviewed journal articles in scientific debate. Of course, that was when it was criticizing Applicant's scientific evidence of lower-energy hydrogen predicted by his theory, prior to publication of that evidence, as "not having the credibility that peer-reviewed articles have." [See, for example, page 5 of the Committee's May 19, 2004 Office Action in U.S. App'n Ser. No. 09/352,693.] Now that Applicant's evidence has been widely published in peer-reviewed articles appearing in highly esteemed scientific journals, the Committee has the audacity to claim that his theory lacks support in the scientific community.

Consistent with its "allowance is not an option" policy, the Committee takes this extreme position even farther by claiming that Applicant's real-world evidence that lower-energy hydrogen <u>actually</u> exists "<u>detract</u>[s] from the central issue that the hydrino does not <u>theoretically</u> exist" and that "all of applicant's data cannot prove what is <u>not</u> <u>theoretically possible</u>." [See, for example, May 12, 2005 Advisory Action in U.S. App'n

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[103] As explained more fully below, Applicant has complied with the Committee's required showing of support in the scientific community despite attempts by his competitors to undermine that support by disparaging Applicant and his technology. The extent to which members of the Committee, including BMS President Souw, have knowledge of, or involvement in, such activities, that information is highly relevant to the issue of whether Applicant's lower-energy hydrogen technology has support in the scientific community and, therefore, must be disclosed.

Ser. No. 09/669,877 at page 2 (emphasis added).] Thus, even when Applicant complies with the Committee's "support in the scientific community" standard by submitting scientific evidence that has been peer-reviewed by highly qualified PhD's scientists and accepted for publication in esteemed scientific journals, since, according to the Committee, that credible evidence is rejected because it supposedly "detracts" under a different patentability standard that improperly presumes his invention to be *per se* incredible.

Out of the multitude of unsupportable and conflicting patentability standards that the Committee has put forward over the years, this one truly stands out as perhaps the most outrageous. Applicant has spent enormous amounts of effort and money complying with the PTO's unlawful requirement that he publicly disclose in peer-reviewed publications confidential data generated by Applicant and independent third parties to prove the existence of lower-energy hydrogen. The only way to now settle the debate on whether lower-energy hydrogen actually exists is to properly evaluate that real-world evidence. For the Committee to now assert that those efforts were for naught, since Applicant's evidence "detract[s] from the central issue that the hydrino does not theoretically exist," turns science on its head and is an embarrassment to a government agency charged with "promot[ing] the Progress of Science and useful Arts." [See U.S. Constitution, Art. I, Sect. 8, Clause 8.]

The Committee's ridiculous position that it need not seriously analyze Applicant's scientific data because the existence of lower-energy hydrogen is incredible based on an alleged theoretical impossibility—at least according to its misguided view of quantum mechanics—further violates well-established patent laws and procedures. Indeed, the PTO's own procedures outlined in MPEP § 2107, p. 2100-31 require that the Examiner not start from the premise that an invention is "incredible," by mandating that:

> [The Examiner] should not begin an evaluation of utility by assuming that an asserted utility is likely to be false, based on the technical field of the invention or for other general reasons. . . A conclusion that an asserted utility is incredible can be reached only after the Office has evaluated both the assertion of the applicant regarding utility and any evidentiary basis of that assertion. The [Examiner] should be particularly careful not to start with a presumption that an asserted utility is, *per se*, "incredible" and then proceed to base a rejection under 35 U.S.C. 101 on that presumption.

Amazingly, when Applicant first criticized the Committee's error in refusing to consider Applicant's supporting evidence, under the presumption that the utility of his novel hydrogen technology is *per se* incredible, the Committee vehemently denied that it had ever taken the position that the existence of lower-energy hydrogen was impossible. Even the Committee's most prominent member, Examiner/BMS President Souw, has offered the same denial:

> Contrary to Applicant's allegation on pg. 13, 1st full paragraph, lines 2-4, the PTO's view is not at all that the existence of lower-energy hydrogen were [sic] impossible, but instead, that (a) Applicant's invention is not supported by any experimental fact or evidence, and (b) the underlying theory (i.e., GUT/CQM) fails to support the invention, because it contains too many flaws. [See, for instance, Souw Appendix at p. 3 attached to the Committee's Final Office Action mailed August 24, 2004 in Applicant's U.S. App'n Ser. No. 08/467,051 (emphasis added).]

The Committee, however, has contradicted itself by now readily admitting that it has dismissed the totality of Applicant's submitted scientific evidence based on the false presumption that "all of applicant's data cannot prove what is not theoretically possible." Applicant is hard pressed to imagine an approach to patent examination any more arbitrary and capricious than that.

In yet another blatant contradiction, the Committee resurrected its previously abandoned argument claiming that Applicant's novel hydrogen technology violates physical laws. When pressed to identify even a single law that is violated, the Committee continuously failed to do so. Apparently feeling the pressure to at least attempt to back up its claims, the Committee now relies upon the Krieg "reference"— actually a non-peer reviewed web page posted on the internet[104]—to allege that the "ground state of an electron of a hydrogen atom" is just such a law:

> Applicant argues (page 20) that the "committee" has failed to identify "even a single physical law" which has been violated. In paper no. 40, referring to the Krieg reference, the Office has shown that Applicant's theory violates the physical law concerning the ground state of an electron

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[104] Applicant has rebutted the Krieg web page arguments supposedly showing that the ground state of hydrogen is a physical law, without an effective response from the Committee. [See, e.g., pp. 140-42 of Applicant's Response filed January 17, 2006 in U.S. App'n Ser. No. 09/008,947.]

of a hydrogen atom. On page 3 of his article (actually a webpage), Krieg uses an energy balance (potential + kinetic = total), the basic laws of electricity and magnetism, the uncertainty principle, and ordinary calculus to prove that the minimum energy level is the normally accepted "ground state." [See page 3 of the July 18, 2005 Final Office Action issued in U.S. App'n Ser. No. 09/008,947.]

The Committee's allegations are akin to the beliefs held by those who originally thought the earth was flat and that the sun revolved around the earth before breakthrough scientific evidence proved them wrong. The Committee is now in the embarrassing position of dismissing Applicant's scientific evidence demonstrating that the hydrogen atom can be made stable below the ground state because accomplishment of that feat supposedly violates a physical law forbidding such lower energy states. The Committee's circular reasoning, however, does not reflect well on a government agency charged with promoting the progress of science. If complying with physical laws is indeed the standard the Committee is applying, then surely it must condemn SQM, with all of its anomalies that have no basis in reality, and embrace Applicant's CQM, which is premised on compliance with physical laws even at the atomic level.

That would be true but for the fact that the Committee is not constrained by the same standards it unfairly applies against Applicant. Thus, according to the Committee:

> Applicant's tentative recitation of E.H. Lieb's article is flawed and also misleading, since Lieb does not mention anything about hydrino. The fact that SQM contains parts that need improvement is scientifically acceptable, since (a) no physical theory is all encompassing, and (b) there would otherwise be no progress in science. [Page 18 of Souw Appendix A.]

This latest double standard further exposes the weakness of the Committee's case. When it comes to flawed, outdated quantum theory, upon which the Committee relies so heavily to support its position, the fact that it needs improvement is marginalized as "scientifically acceptable." Yet, the Committee requires that Applicant's modern and more advanced theory that accurately predicts the existence of lower energy states be perfect in every detail—which it is—before it will deem Applicant's experimental evidence credible enough to be worthy of consideration. This

clear double standard make a mockery of the Committee's examination of Applicant's hydrogen technology.

Put another way: How can the Committee on the one hand admit that outdated quantum theory "needs improvement," yet on the other, seriously claim that this flawed theory rises to the level of a sound "scientific principle" that serves as the basis for asserting that the existence of lower energy states of hydrogen predicted by Applicant's modern theory is "incredible"? This unsustainable, flawed position sounds the death knell for the Committee's rejections in all of Applicant's cases, which rejections should therefore be withdrawn immediately.

Furthermore, the Committee's assertion that Applicant's novel technology based on lower energy states of hydrogen violates physical law and thus can't possibly work even contradicts the express position taken by its conflicted lead Examiner, BMS President Souw. As noted above, when Applicant previously criticized the Committee for its failure to fairly consider Applicant's scientific evidence on the basis that the existence of lower-energy hydrogen was impossible, Dr. Souw took exception to that criticism claiming that "[t]he PTO's view is not at all that the existence of lower-energy hydrogen were [sic] impossible." [See, for instance, Dr. Souw's Appendix at p. 3 attached to the Committee's August 24, 2004 Office Action filed in Applicant's U.S. App'n Ser. No. 08/467,051.] Clearly then, if Dr. Souw does not consider the existence of lower-energy hydrogen impossible, such lower energy states cannot be in violation of any physical law, much less the one now identified by the Committee as "the physical law concerning the ground state of an electron of a hydrogen atom." In now taking a contrary position, the Committee has unwittingly undermined the credibility of Dr. Souw and calls into question other views expressed by him.

The only consistency found throughout this myriad of contrived vague and double standards—and often no standards at all—is the Committee's use of each to excuse it from fairly considering and evaluating Applicant's scientific evidence that lower-energy hydrogen does indeed exist. The Committee prefers instead to engage in a theoretical debate to the exclusion of that evidence, pitting its outdated quantum theory, with all of

its far-fetched and disproved predictions, against Applicant's modern theory of classical quantum mechanics that correctly predicts the formation of lower-energy hydrogen.[105]

Applicant has willingly engaged the Committee in this theoretical debate, and will continue to do so if necessary, even though the patent laws do not require that an inventor understand the precise theoretical basis for why his invention works. All the law requires is that he disclose his invention in sufficient detail to enable one of ordinary skill in the art how to practice it. Applicant has done precisely that and the Committee has failed in its burden to show otherwise.

Of course, the debate over these competing theories can go on indefinitely without resolution, which may be the Committee's strategy. Engaging in that intellectual exercise, however, will not—indeed cannot—definitively settle the question of whether practicing Applicant's disclosed hydrogen chemistry results in the formation of lower-energy hydrogen. Like any good theoretical debate, this one can only be tested and ultimately settled by fully and fairly evaluating the unprecedented amount of real-world experimental evidence Applicant has submitted conclusively confirming the lower energy states of hydrogen. Applicant has expended tens of millions of dollars amassing this experimental evidence. The least the Committee can do is properly consider it.

In the few isolated instances in which the Committee has addressed Applicant's evidence, it offers far-fetched reasons for dismissing it without a fair hearing, again demonstrating its arbitrary and capricious approach to examination of his cases. One prominent example occurred early on during the February 21, 2001 Interview held in all of BlackLight's then-pending lower-energy hydrogen applications, which was led by Examiner Vasudevan Jagannathan—one of the few Committee members Applicant has been able to successfully identify. At that interview, Applicant had a brief opportunity to present some of his scientific evidence, including spectroscopic data that is extraordinarily reliable in identifying chemical compositions. Such data amounts to a "chemical fingerprint" that cannot be seriously disputed. Despite the conclusiveness of

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[105] Applicant's modern theory, which applies classical laws to the electron, not only solves everything Quantum Mechanics and Quantum Electrodynamics can do better using physical laws, but also solves problems that Quantum cannot do, such as solving for the masses of fundamental particles and predicting the acceleration of the expansion of the Universe. Applicant's modern theory can further solve, for example, all atomic and molecular orbital current density functions, the corresponding energies, the corresponding bond energies, and the bond parameters for all molecules.

that evidence, Examiner Jagannathan dismissed it out of hand as nothing more than "a bunch of squiggly lines."

To put the absurdity of that comment in context, the PTO rationalized its withdrawal of BlackLight's five allowed patent applications, in part, by citing a January 12, 2000 article written by Dr. Robert Park, spokesman for one of Applicant's main competitors, the American Physical Society (APS). [March 22, 2000 Decision at page 7 (Attachment G).] In that article, Dr. Park made the following startling statements:

> The energy states of atoms are studied through their atomic spectra—light emitted at very specific wavelengths when electrons make a jump from one energy level to another. <u>The exact prediction of the hydrogen spectrum was one of the first great triumphs of quantum theory; it is the platform on which our entire understanding of atomic physics is built. The theory accounts perfectly for every spectral line</u>.
>
> <u>There is no line corresponding to a "hydrino" state. Indeed there is no credible evidence at all to support Mills' claim</u>. [See Attachment J at 4 (emphasis added).]

The incredible irony here—one that cannot be easily overlooked—highlights once again the extreme arbitrary and capricious approach the Committee has taken in examining this and other BlackLight applications. There is no question that the vitriol espoused by Dr. Park in his cited *Post* article was, at least, partially responsible for the PTO's suspect "eleventh-hour" withdrawal of the five allowed BlackLight applications from issue. And yet, despite the fact that the very article the PTO relies upon to deny Applicant his patents recognizes that spectroscopic data is extraordinarily reliable— indeed, the "platform on which our <u>entire</u> understanding of atomic physics is built"—the Committee nonetheless continues to cavalierly ignore or dismiss that same data when submitted by Applicant.

Out of exasperation, Applicant queried Examiner Jagannathan during the February 21, 2001 Interview as to what type and quality of evidence would convince him that lower-energy hydrogen exists. In response, the Examiner required that Applicant publicly divulge confidential information by publishing his experimental evidence in peer-reviewed scientific journals for that evidence to be considered reliable. As detailed above, Applicant has more than met this newly created "publication" standard for

considering his experimental evidence by submitting over 100 scientific papers for publication, even though the PTO's rules and procedures impose no such requirement. So far, over 65 of these papers have completed and passed the peer-review process conducted by highly qualified Ph.D. referees.

Applicant's experimental evidence has been extensively peer-reviewed and published in the following esteemed journals:

Applied Physics Letters
Chemistry of Materials
Electrochimica Acta
European Journal of Physics D
European Physical Journal: Applied Physics
Fusion Technology Journal of New Materials for Electrochemical Systems
IEEE Transactions on Plasma Science
International Journal of Hydrogen Energy
Journal of Applied Physics[106]
Journal of Material Science
Journal of Molecular Structure
Journal of Optical Materials
Journal of Plasma Physics
Journal of Physics D: Applied Physics
Journal of Quantitative Spectroscopy and Radiative Transfer
Journal of New Materials for Electrochemical Systems
New Journal of Physics
Physics Essays
Plasma Sources Science and Technology
Solar Energy Materials & Solar Cells
Thermochimica Acta
Vibrational Spectroscopy

Additionally, Applicant's experimental evidence has been submitted for peer-review and publication in the following esteemed journals:

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[106] Applicant notes that the *Journal of Applied Physics* is the very same journal cited by the Committee as credible evidence that Dr. Souw, one of its premier members, is supposedly qualified to evaluate Applicant's novel hydrogen technology. [See *infra*.]

Acta Physica Polonica A

AIAA Journal

Anuoles de la Fondation Louis de Broglie

Brazilian Journal of Physics

Canadian Journal of Physics

Central European Journal of Physics

Chemical Engineering Science

Contributions to Plasma Physics

Current Applied Physics

Europhysics Letters

Fizika A

Foundations of Science

Journal of Applied Spectroscopy

Journal of Mathematical Physics

Journal of Materials Research

Journal of Physical Chemistry A

Journal of Physical Chemistry B

Journal of Vacuum Science & Technology A

Materials Characterization

Materials Chemistry and Physics

New Journal of Chemistry

Physical Review B

Physica Scripta

Spectrochimica Acta Part B: Atomic Spectroscopy

Thin Solid Films

Vacuum

Once again, however, the Secret Committee has raised the bar to patentability by arbitrarily and capriciously ignoring this vast body of evidence that it required Applicant to submit. The Committee apparently believes that its anonymous members are better qualified than the numerous skilled PhD's who peer-reviewed and approved the contents of Applicant's articles confirming the existence of lower-energy hydrogen.

The PTO's mishandling of the experimental evidence of record in this case is but one of several improper actions that have adversely effected Applicant's patent rights. Others include:

(1) illegally withdrawing or threatening to withdraw other copending BlackLight patent applications from issue, after initially allowing all claims, under highly suspicious circumstances that suggest likely interference by BlackLight's competitors;

(2) improperly examining this application by Secret Committee, effectively denying Applicant the right to confront the persons involved in that examination, to assess their qualifications and biases, and to ascertain whether those persons include BlackLight's competitors or other improper outside influences, in breach of PTO confidentiality requirements; and

(3) refusing reasonable requests by Applicant and five U.S. Senators to divulge information relating to the events that triggered the PTO's withdrawal action, and the identity of all PTO employees and non-PTO personnel involved in examining BlackLight's applications.

These improper actions bear directly upon the prosecution of BlackLight's pending applications, yet Applicant's good faith efforts to discuss and resolve these and other outstanding issues have been either ignored or rejected out of hand. One of Applicant's many overtures was communicated directly to then PTO Director James E. Rogan in a letter dated December 21, 2001, from BlackLight board member Dr. Shelby T. Brewer. Dr. Brewer received his Ph.D. in Nuclear Engineering from M.I.T. and served as Assistant Energy Secretary in the Reagan administration.[107] [See Attachment A.]

As stated in his letter, Dr. Brewer's reasons for appealing to Director Rogan were motivated not only by his fiduciary duty to protect BlackLight's interests, but also by a sincere desire to avoid unnecessary embarrassment to the PTO over these lingering issues if left unresolved. Dr. Brewer appealed for a meeting with Director Rogan in an attempt to bring some closure to this matter in a way that might mutually benefit both sides.

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[107] Other prominent Directors on BlackLight's board include: Michael H. Jordan, CEO of Electronic Data Systems, Vice Admiral Michael P. Kalleres, former Commander of the U.S. Second Fleet, General Merrill A. McPeak, former Chief of Staff of the U.S. Air Force, and Neil Moskowitz, CFO of Credit Suisse First Boston.

Despite the urgency of his plea, Dr. Brewer waited over four months before finally receiving a response to his request for a meeting. In a curt letter dated April 24, 2002, from the Director's Chief-of-Staff, Jason C. Roe, the PTO advised: "We appreciate your interest in this matter, but, unfortunately, must decline your request for a meeting due to the fact that the USPTO is not in a position to discuss the issue at the present time." [See Attachment A.] The PTO's response, however, merely begs the question: if not now, when will it be in a position to have these discussions?

This negative response, while disappointing, was hardly surprising. In refusing to meet with Applicant, the PTO continues to treat prosecution of this and BlackLight's other copending cases as an adversarial proceeding. While the PTO may believe it is justified in shrouding its untoward actions under a cloak of secrecy and remaining answerable to no one, that approach does little to preserve public confidence in the patent process. Only by openly engaging Applicant in mutually beneficial discussions of all the issues in this case can the PTO ever hope to achieve that worthy goal. Applicant therefore implores the PTO to reconsider its policies and adopt a more flexible and cooperative approach by agreeing to meet with Applicant to discuss the handling of this and other pending BlackLight applications before taking any further action.

Perhaps the PTO sees no need to modify its approach, buoyed by the Federal Circuit's June 28, 2002 Decision upholding its withdrawal action that cancelled issuance of BlackLight's allowed patent applications. [See *BlackLight Power, Inc. v. Director James E. Rogan*, 63 USPQ2d1534 (Fed. Cir. 2002) (Attachment B).] The Federal Circuit ruled, among other things, that an "emergency situation" trumped the controlling regulation requiring the PTO to determine the unpatentability of one or more claims before it withdrew the '294 application from issue so that the PTO's mere "concern" over patentability provided adequate basis for the withdrawal. That Decision, aside from the fact that it is erroneous,[108] does not even begin to resolve other issues that touch on the merits of this case.

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[108] Applicant believes that the Federal Court's opinion is erroneous due, in part, to its misreading of a concurring opinion of one Justice in a 38-year-old Supreme Court case to support its holding that this supposed "emergency situation"—a finding that was not supported by the record or even argued by the PTO—justified the PTO's withdrawing BlackLight's copending '294 application from issue on February 17, 2000, after payment of the issue fee. See *BlackLight Power* at page 7 *citing Baltimore & Ohio Railroad*

One such issue is how this alleged "emergency situation" arose in the first place, *i.e.*, how the PTO became aware of BlackLight's issued U.S. Patent No. 6,024,935 (the '935 patent) that supposedly raised "concerns" about other pending applications. That issue apparently was not important to Associate Solicitor Kevin Baer who defended the PTO's conduct by arguing to the District Court: "I would even say, Your Honor, you could imagine in our head any scenario of how we learned about it. A blimp flying over us. It doesn't matter, because what matters, Your Honor, is the decision [to withdraw] itself." [May 22, 2000 Transcript at 52 (Attachment K, Tab E).]

Judge Sullivan, however, was apparently unimpressed by those comments, noting in footnote 10 of his opinion that he was "troubled by several steps in the PTO's process" and advising the PTO to "examine its patent issuance process so that their normal operations are not compromised by such seemingly suspicious procedures." [See 109 F.Supp. 2d 44, 53-54, n.10 (Attachment L).]

While the PTO may be unconcerned how it learned of the '935 patent, Applicant considers that information critically important. If, for instance, competitors were somehow involved in events leading to the withdrawal of BlackLight's allowed applications and, perhaps, in the subsequent prosecution of those and other applications, that information would relate directly to the credibility of the rejections entered in those cases, including this one. Applicant therefore renews his request for a

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Co. v. United States, 386 U.S. 372, 421 (1964) (Brennan, J., concurring) (recognizing the importance of leaving the Interstate Commerce Commission (ICC) great flexibility to deal with emergency situations to avoid serious damage to the national transportation system, but finding no pressing need that justified the ICC's action). The Federal Circuit stretched that case way beyond the limits of Supreme Court precedent that requires government agencies to strictly follow statutory and regulatory guidelines.

Incredibly, at oral argument, the PTO did not even suggest that an emergency situation had forced it to withdraw this application from issue on February 17, 2000. To the contrary, PTO Solicitor John M. Whealan argued that no withdrawal—emergency or otherwise—occurred on that date and admitted that, if the Court found otherwise, his case would be seriously compromised. This was because, at that time, the PTO could not locate the patent file and admittedly could not have made a determination of unpatentability of one or more claims as required by the controlling regulation. *See* 37 C.F.R. § 1.131(b)(3); MPEP § 1308 (7th Ed., Rev. 1, Feb. 2000). To avoid an adverse ruling, Solicitor Whealan sought refuge outside the administrative record, suggesting for the first time that the PTO had used the wrong form in mistakenly notifying Applicant on February 17 that his application had been withdrawn. Then, again without evidentiary support, the Solicitor tried to convince a skeptical Court that Director Kepplinger, in consultation with the Examiner, had made an unpatentability determination sometime later, after Applicant had voluntarily supplied the PTO with a copy of the application—hardly an emergency situation if it were true.

full accounting of how, out of the thousands of patents the PTO issues every week, his '935 patent came to its attention, thus leading to the withdrawal of BlackLight's allowed applications.

Applicant believes that concerns over outside influences on the prosecution of his applications are fully justified. Following the PTO's withdrawal action, counsel immediately investigated the facts and circumstances surrounding that action by questioning various PTO personnel. In discussions with Director Esther Kepplinger, she admitted to counsel that the withdrawal was a reaction to perceived heat—a "firestorm" as she put it—the PTO had received from an undisclosed outside source. Director Kepplinger further indicated that the withdrawal occurred only after BlackLight's '935 patent had been brought to the attention of then-Director Q. Todd Dickinson by Gregory Aharonian, another PTO outsider well known for publicly attacking issued U.S. patents.[109]

Director Kepplinger's revelations are truly disturbing in that they describe what is essentially a newly created non-statutory reexamination procedure for opposing the issuance of patents never envisioned by Congress. Compare 35 U.S.C. §§ 301-307 (patent reexamination statutes).

Following the PTO's drastic withdrawal action, Applicant discovered other reliable information suggesting the likelihood of outside interference with BlackLight's patent applications and breaches of the PTO' s duty to maintain the confidentiality of those applications. Applicant initially learned that Dr. Peter Zimmerman, former Chief Scientist for the State Department, had published an Abstract of an upcoming speech to the American Physical Society (APS)—a BlackLight competitor—boasting that his Department and the Patent Office "have fought back with success" against BlackLight. [See Attachment K, Tab C.] In conversations with BlackLight's counsel, Dr. Zimmerman admitted that he had received information concerning BlackLight's applications through e-mails from Dr. Robert Park, spokesman for the APS, who told him of a contact in the

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[109] See Applicant's February 28, 2000 letter to Director Kepplinger documenting telephone and personal conversations between her and Applicant's counsel regarding improper outside influence that precipitated the withdrawal of BlackLight's five allowed applications. The PTO cited this letter in its March 22, 2000 Decision affirming its withdrawal action. [See Attachment G.]

PTO referred to by Dr. Park as "Deep Throat" with access to confidential patent information. [See letter dated July 10, 2000 (Attachment K, Tab C).]

An *APS News Online* bulletin, dated August/September 2002, suggests that Dr. Park is maintaining his questionable PTO contacts, apparently with the agency's blessing:

APS E-Board Passes Resolution on Perpetual Motion Machines

The APS Executive Board approved a resolution at its June 2002 meeting in Annapolis, MD, affirming the fraudulent nature of claims of perpetual motion machines.

The resolution was deemed necessary because of a recent increase in patent applications for such devices. <u>Robert Park, APS Director of Public Information and author of the weekly electronic newsletter, "What's New," reported that the US Patent Office has received several patent applications for perpetual motion machines during the first six months of this year alone.</u> [Park's 2000 book, *Voodoo Science*, devoted considerable space to the phenomenon of such devices throughout history.] The text of the APS resolution follows.

The Executive Board of the American Physical Society is concerned that in this period of unprecedented scientific advance, misguided or fraudulent claims of perpetual motion machines and other sources of unlimited free energy are proliferating. Such devices directly violate the most fundamental laws of nature, laws that have guided the scientific progress that is transforming our world.

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[Attachment Q (emphasis added).] Dr. Park's knowledge of the number of pending patent applications filed in the PTO directed to a particular subject matter—information that is supposedly kept confidential—raises additional questions as to his activities in interfering with the prosecution of U.S. patent applications.[110]

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[110] Not coincidently, the Committee initially attacked the operability of Applicant's invention by mischaracterizing it as a "perpetual motion machine" and, therefore, *per se* unpatentable. The Committee quickly withdrew that line of attack after Applicant showed it was completely lacking in any merit.

Of course, this should come as no surprise since Dr. Park has admitted his direct involvement in BlackLight's patent affairs, as evidenced by the September 6, 2002 issue of *What's New* he authored and published on the APS website:

> The status of BlackLight Power's intellectual property is fuzzier than ever. BLP was awarded Patent 6,024,935 for "Lower-Energy Hydrogen Methods and Structures," a process for getting hydrogen atoms into a "state below the ground state". . . . You might expect these shrunken hydrogen atoms, called "hydrinos," to have a pretty special chemistry. Do they ever! Indeed, a second patent application titled "Hydride Compounds" had been assigned a number and BLP had paid the fee. Several other patents were in the works. That's when things started heading South. Prompted by an outside inquiry (who would do such a thing?), the patent director became concerned that this hydrino stuff required the orbital electron to behave "contrary to the known laws of physics and chemistry." The Hydride Compounds application [the '294 application] was withdrawn for further review and the other patent applications were rejected. [September 6, 2002 Online Newsletter of Dr. R. Park, *What's New* (Attachment C) (emphasis added).]

Dr. Park's startling admission was confirmed two weeks later in the September 20, 2002 issue of the *Online Newsletter* published by the James Randi Educational Foundation (JREF). In it, James Randi gleefully boasted about Dr. Park's contacting the Patent Office with the express purpose of sabotaging Applicant's patent rights:

> But why, hard on the heels of re-examining other questionable patents (see three weeks ago on this page), would the Patent Office have happened upon this particular one [BlackLight's withdrawn '294 application], when there are so many in this category? The secret can be inferred from Bob Park's weekly column, where we find: "Prompted by an outside inquiry (who would do such a thing?) . . ." That rascal!
>
> The very fact that the Patent Office has paid heed to the complaints that Park, the JREF, and others have made, speaks well for rationality. Let's hope that we can look forward to many quack devices and systems being re-evaluated. Let's see a lot more of this "extraordinary action" from the Director. As for BlackLight Power, says Park, "Their long-awaited IPO may have to wait a little longer." [September 20, 2002 Online Newsletter of the JREF, *Swift* (Attachment C) (emphasis added).]

Despite all of this overwhelming incriminating evidence of improper outside interference by competitors with an administrative patent proceeding—a possible criminal offense—the PTO continues to ignore this serious matter. Indeed, the PTO tries to deflect attention away from this incriminating evidence by addressing points that

have nothing to do with Dr. Park's "Deep Throat" contacts at the PTO, or by advancing

arguments that actually confirm his interference in the examination of Applicant's

pending patent applications:

> Applicant has made numerous references to a Dr. Robert Park, whom he alleges to have had contact with a "Deep Throat" in the Office (page 31), and to have had "direct involvement in Blacklight's patent affairs" (page 32), "Blacklight" being the name of applicant's business. While applicant argues (page 24) that "the PTO rationalized its withdrawal of Blacklight's five allowed patent applications, in part, by citing a January 12, 2000 article written by Dr. Robert Park", citing a published article hardly constitutes contact with the author. The reference to the present applicant in the article does not mean that Dr. Park had obtained confidential information from the Office, because applicant published an edition of his book, *The Grand Unified Theory of Classical Quantum Mechanics*, in January 2000. While applicant argues (page 32) that Dr. Park knew about several of applicant's applications, the knowledge of which "is supposedly kept confidential", the Washington Post article by Dr. Park which refers to applicant's patent and a second application set to issue two weeks thereafter was published on 18 August 2000, which was three days after the publication of the U.S. District Court decision (part of Attachment K) which referred in which these applications were mentioned (page 1 thereof). Thus, both articles written by Dr. Park appear to be based on information that was already made public at the two respective times that the articles were published. No "Deep Throat" or other improper contact would have been necessary. [See, for example, the November 21, 2005 Office Action filed in App'n Ser. No. 09/110,678 at p. 5; and the December 12, 2005 Advisory Action filed in App'n Ser. No. 09/110,694 at p. 5.]

The mention of Blacklight Power in the January 12, 2000 article referenced

above was never put forward by Applicant as a basis for claiming Dr. Park had a "Deep

Throat" contact at the PTO. It was cited merely to show the PTO's reliance on someone

who, as shown by other evidence, had an agenda to sabotage Applicant's patent

applications and who boasted about having done so.

When the Committee finally gets around to addressing <u>one piece</u> of that

evidence Applicant used to show Dr. Park's receipt of illicit information from the PTO,

the Committee misconstrues it in a way that actually supports Applicant's position.

Specifically, as cited above, the <u>September 2002</u> issue of the *APS News Online* bulletin

suggests that Dr. Park has maintained his questionable contacts at the PTO well after

Applicant's allowed applications had been withdrawn years earlier. Again, the APS

states in that bulletin that: "Robert Park, APS Director of Public Information and author of the weekly electronic newsletter, "What's New," reported that the PTO has received several patent applications for perpetual motion machines during the first six months of this year alone." [Emphasis added.] Based on that eye-opening disclosure, Applicant argues, and rightfully so, that Dr. Park's knowledge of information that "is supposedly kept confidential"—referring not to Applicant's previously known applications, but to the unknown applications of others—raised additional questions as to his activities involving interference with the prosecution of U.S. patent applications.

The Committee confuses that evidence, and convolutes Applicant's arguments, in asserting that "Applicant argues (page 32) that Dr. Park knew about several of applicant's applications, the knowledge of which 'is supposedly kept confidential'." [Emphasis added.] Applicant has cited other evidence of Dr. Park's knowledge of applicant's applications, which, to date, the Committee has completely ignored. The evidence the Committee refers to above, however, demonstrates Dr. Park's "insider status" at the PTO by showing he had received illicit information about other applicants' filed applications in 2002. Thus, the fact that articles were written in 2000 about Applicant's applications or that applicant's applications due to issue in 2000 were otherwise mentioned has absolutely nothing to do with Dr. Park's knowledge in 2002 of different applications filed by others that year.

Due to the Committee's obvious confusion on this point, it erroneously concludes that "both articles written by Dr. Park appear to be based on information that was already public at the two respective times that the articles were published" and "[n]o 'Deep Throat' or other contact would have been necessary." To the contrary, Applicant has presented considerable evidence that, in fact, Dr. Park has had, and continues to maintain, improper contacts at the PTO based on Dr. Park's and Dr. Zimmerman's own admissions discussed above regarding Dr. Park's knowledge of confidential PTO filings, including information pertaining to Applicant's pending patent applications. The least the Committee can do is fairly and accurately address that evidence, which it has yet to do.

In limiting its consideration to but a small fraction of that evidence, as mischaracterized above, the Committee nonetheless has at least acknowledged the

relevance and seriousness of Dr. Park's improper contacts with the PTO. In making that case for Applicant, the Committee is obliged consider and respond to all of the evidence Applicant has presented on this important issue.

Apparently, this is not the first time that Dr. Park, James Randi and PTO officials have been embroiled in a patent controversy such as this one involving improper interference with a patent proceeding. Less than a year before Applicant's five allowed applications were withdrawn from issue in February 2000, the PTO was caught up in another scandal of sorts involving the issuance of U.S. Patent Nos. 5,748,088 and 6,011,476, granted on a device that can identify the obscured location of living entities. Following issuance of the '088 patent, Dr. Park published in his *What's New* newsletter inaccurate, disparaging remarks, which were picked up by James Randi on his JREF website, concerning the operation and reliability of the claimed invention. [Attachment H] An article published May 21, 1999 in *Science Magazine* during the pendency of the '476 patent also reported on the controversy and the involvement of Sandia National Labs (SNL) in the testing of the device. [Attachment D]

SNL's involvement and the disclosure of confidential information to David Voss, the author of the *Science* article, was itself the subject of some controversy and resulted in the issuance of an internal PTO memorandum that was placed in the '476 patent file. In that memorandum, the PTO felt compelled to reiterate its policy forbidding PTO employees from making public disclosures concerning pending patent applications:

PTO MEMORANDUM FOR ALL EMPLOYEES: MEDIA CONTACT POLICY

Posted Date: 06/25/99
Removal Date: 07/06/99

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER OF PATENTS AND
TRADEMARKS
Washington, D.C. 20231

June 22, 1999

99-42

MEMORANDUM FOR All Employees

FROM: Acting Assistant Secretary of Commerce and Acting
Commissioner of Patents and Trademarks

SUBJECT: Media Contact Policy

Since a memorandum on this subject was first issued several years ago,
thousands of new employees have joined the PTO. Therefore, it is a good
time to reiterate PTO policy concerning employee contact with members
of the media including, but not limited to, those in print, broadcast, cable,
and online publications.

All requests, including telephone and e-mail, from members of the media
for interviews, tours, and appearances should be directed to the Office of
Public Affairs (Richard Maulsby or Brigid Quinn). Public Affairs will then
determine the appropriate Office response for such requests and arrange
for all interviews and any other meetings with the media. A member of the
Public Affairs staff may attend interviews and meetings.

This policy applies only to contact with the media, not to interactions with
customers. Any questions about media contact should be directed to the
Office of Public Affairs at 305-8341.

Additionally, MPEP section 1701 and TMEP section 1801 specify that
Office personnel should not comment on the validity or enforceability of
any U.S. patent or trademark registration. These sections also caution
employees about answering other particular inquiries concerning U.S.
patents or trademark registrations. Any questions on this policy should be
directed to your supervisor or to the MPEP Editor at 305-8813 for patents
or to the Office of the Assistant Commissioner for Trademarks at 308-
8900. [Attachment E]

Curiously, SNL is where Dr. Park previously served as head of its Surface

Physics Division, leading Applicant to wonder whether SNL, or any of its sister labs,

have had any similar involvement in the examination of this and other BlackLight

applications. Applicant's curiosity on this point is further heightened by the fact that

Examiner Bernard Souw, a former employee with Brookhaven National Labs, is a

premier member of the Secret Committee who has been engaged in the examination of

BlackLight's patent applications for some time now. [See, e.g., App'n Ser. No.

09/513,768.] As discussed below, Examiner Souw's activities as lead scientist for a

company he owns in competition with BlackLight, while examining BlackLight's patent

applications, raises a genuine conflict of interest, thus adding further cause for concern over outside interference with Applicant's patent rights.

If, as Applicant suspects, the PTO has conferred with others having ties to the APS, like Dr. Park or Dr. Zimmerman, or to other BlackLight competitors in withdrawing or rejecting BlackLight's applications, that information would be highly relevant and thus must be disclosed. Obviously, knowing the identity and potential biases of all persons providing input or otherwise involved in rejecting BlackLight's applications, especially those with competing interests, bears directly on the credibility of those rejections. This point could not have been made more clear than the Committee's adoption of Examiner Souw's biased views in formulating its rejections in this case.

Applicant has, on numerous occasions, disclosed to PTO officials information relating to Dr. Park's undermining of BlackLight's patent rights, as relayed in Dr. Brewer's December 21, 2001 letter to then PTO Director Rogan, only to be ignored. [Attachment A; see also, for example, January 19, 2001 letter to Director Kepplinger (Attachment K).] As Dr. Brewer explained in his letter, BlackLight is obviously concerned, among other things, that the PTO may have once again breached its duty to maintain confidentiality of U.S. patent applications under 35 U.S.C. § 122, 18 U.S.C. § 2071, 37 C.F.R. § 1.14, and M.P.E.P. § 101. The PTO's curt statement that it is "not in a position to discuss the issue at the present time" does little to allay those concerns.

Dr. Brewer further expressed in his letter distress over the suspected compromise of Applicant's patent rights to his novel hydrogen chemistry by a group of physicists with a vested interest in maintaining federal funding for projects based on a competing scientific theory and concern that those physicists continue to exert improper influence over the prosecution of BlackLight's pending applications. Those suspicions are only fueled by continued PTO silence on these issues while it undercuts Applicant's patent rights based on statements of competitors like Dr. Park. For instance, in the March 22, 2000 Decision justifying its withdrawal of Applicant's allowed patent applications, the PTO relied, in part, on a *Washington Post* article written by Dr. Park only slightly more than a month prior to the withdrawal:

> While petitioner in the accompanying letter points to favorable
> testimonials from scientists and entrepreneurs regarding the "revolutionary

technology" that the instant application is asserted to embody, this does not establish that either the Director, Technology Center 1700, or the Director, Special Programs Law Office, committed reversible error, nor that the Notice should be withdrawn. In contrast, mainstream newspapers have reported this same "revolutionary technology" is accompanied by controversy in the scientific community. See Baard et al., Scientists and entrepreneurs have lots of ideas about new sources of energy; some may even be practical, Wall St. J., Sept. 13, 1999, at R16; **Park, Perpetual motion; still going around, Washington Post, Jan. 12, 2000, at H3.** [March 22 Decision at 7 (Attachment G).]

Applicant is naturally skeptical that this timing was simply a coincidence. Regardless, the mere fact that the PTO would rely on any competitor to "bad-mouth" BlackLight's technology is troubling. That it relied on Dr. Park of all people, known for conducting "hatchet jobs" on new technologies that threaten federal funding for the physicists he represents, is contemptible.

The same *Washington Post* that ran Dr. Park's libelous article rebuked its less than credible author in a subsequent article confirming his reputation for engaging in what it described a "search-and-destroy mission" against inventors and scientists who seek to advance the bounds of science. [See Article dated June 25, 2000 (Attachment M).] To quote the article's exact words, "Park's anger permeates his rebuttals, which border on character assassination." [*Id.* At 1.] Noting that "thoroughness is not Park's strong suit," the article goes on to suggest that his intentions may be less than honorable:

> Park's failure to gather first-hand data is unfortunate, but his selective omissions are far more serious. In at least one case, he violated basic principles of journalism and science itself by apparently suppressing information that conflicts with his foregone conclusion. . . .

> Such tactics are reminiscent of the behavior of a zealous DA who is so convinced that a suspect is guilty that he feels entitled to withhold some information from the jury. [*Id.* at 1-2.]

Dr. Park's competitive motives in attacking BlackLight's novel hydrogen chemistry, and thereby undermining its patent rights, are clear, as further recognized by the *Post* article in its description of Dr. Park as "a Washington lobbyist and PR flack for

the American Physical Society." The article goes on to warn of the serious effects a rush to judgment can have without first-hand review of experimental evidence:

> This is a serious matter, since even poorly documented vitriol can jeopardize a scientist's reputation and future funding if it is disseminated with the complicity of a respected organization such as the American Physical Society. [*Id.* at 2.]

Dr. Park has admitted that there is merit to Applicant's argument that he is hostile to BlackLight, and therefore obviously biased against it, for competitive reasons. As discussed in his January 13, 2006 issue of *What's New* [Attachment C], Dr. Park explains the basis for his hostility:

> We haven't heard much about Mills and his company, BlackLight Power, since they lost a patent appeal three years ago. (WN 6 Sep 02). But with the start of the new year, Dow Jones Newswires ran a story about deep-pocket financial gurus that are backing BlackLight. A retired head of energy banking at Morgan Stanley commented that physicists are "hostile" to Mills' ideas. Bob Park, was the only physicists quoted. Sure enough, he was hostile. "Park represents an entrenched physics establishment that fears losing billions in funding and having its work discredited," Mills explained. [See http://bobpark.physics.umd.edu/WN06/wn011306.html (Emphasis added).]

Dr. Park apparently takes great pride in being the only named physicist hostile to Mills' ideas and, in doing so, he gives credence to the underlying competitive motives for this hostility ascribed to him by Dr. Mills. Having conceded his obvious bias against BlackLight, it is highly inappropriate for the Committee to continue to cite and rely on his views in rejecting Applicant's patent applications.

Incredibly, in rationalizing its withdrawal action, the PTO paid tribute to a "hatchet man" like Dr. Park, who represents a competitor intent on sabotaging BlackLight's patent rights, by citing his hostile statements against BlackLight. Yet, in explaining the issuance of BlackLight's '935 patent, the PTO publicly denigrates its entire examining corps, previously known for their careful study of experimental evidence in deciding whether to issue U.S. patents:

> [P]atent examiners do review [patent applications]. Unfortunately, patent examiners are swamped and sometimes things slip through. [Statement of Associate Solicitor Baer in *BlackLight Power, Inc. v. Q. Todd Dickinson,* May 22, 2000 Tr. at 7 (Attachment K, Tab A).]

[E]xaminers are under tremendous pressure to produce work, and if they're going to approve [an application], they just approve it and kind of let it out the door. [May 22, 2000 Tr. at 48 (Attachment K, Tab A).]

As Dr. Brewer pointed out in his December 21, 2001 letter to Director Rogan, the PTO's outrageous public statements violate 35 U.S.C. § 282, under which statute all issued U.S. patents are presumed to be valid:

Presumption of validity; defenses

A patent shall be presumed valid. Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim. The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting such invalidity.

Underlying this fifty-year-old statutory presumption of validity is the premise of administrative regularity, which presumes that well-trained examiners with expertise in their respective fields properly carry out their examination duties by issuing only valid patents. See, e.g., American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1359 (Fed. Cir. 1984). This presumption was, in fact, confirmed by the capable work of Examiners Langel and Kalafut who, with over 50 years of experience between them, examined and allowed Applicant's '935 patent, along with BlackLight's withdrawn applications. [111]

As succinctly stated in Dr. Brewer's letter, Solicitor Baer's statements on behalf of the PTO should be alarming to just about everyone, with the possible exception of accused patent infringers, and most certainly do not reflect well on an agency charged with maintaining the integrity of the patent system. Applicant felt that a meeting with Director Rogan to secure a retraction of those statements would be mutually beneficial to both sides. Yet once again, inexplicably, the PTO was not, and presumably is still not, prepared to discuss this issue.

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[111] The Examiners initially rejected all claims in these cases, but after conducting five lengthy personal interviews with Applicant and carefully considering Applicant's experimental evidence, they ultimately allowed those claims.

These and other unfair assaults on Applicant's patent rights leave him to ponder: What would motivate the PTO to conduct itself with such total disregard for U.S. patent laws and regulations governing its administrative authority just to attack this one Applicant?

Applicant's fear is that these attacks may be attributable to competitors, like Dr. Park, who are coordinating an organized smear campaign to discredit BlackLight's technology. That fear is only heightened by the PTO's hiding behind strained theoretical arguments as an excuse for refusing to fairly evaluate Applicant's experimental evidence, while using its Secret Committee to issue anonymous rejections in this and other BlackLight applications. Dr. Brewer also brought these issues to Director Rogan's attention as an agenda item for a meeting that, unfortunately, has never taken place.

Applicant has a right to know the identity and qualifications of all persons providing input to, or otherwise participating in, the examination process. This information bears directly on the credibility of the rejections that have been entered in this and other BlackLight applications. For instance, if Dr. Park or any of his physicist cronies have been consulted in denying Applicant his patent rights, it would certainly explain the arbitrary and capricious handling of the experimental evidence of record in those cases.

Particularly germane is the identity of all persons responsible for, or otherwise involved in, creating the Office Actions, Attachments, and Appendices that make up the record in this application and other BlackLight cases. To this day, the Committee has refused, without any adequate explanation, to provide this vital information to the detriment of Applicant.

Furthermore, Applicant is entitled to know which PTO officials are ultimately responsible for analyzing Applicant's scientific data evidencing the existence of lower-energy hydrogen, and which officials have the final authority to decide the fate of BlackLight's applications. The Committee's unfair refusal to divulge that information has also seriously handicapped Applicant's ability to effectively respond to and overcome the rejections of record.

For instance, Applicant has been stymied on numerous occasions in attempts to discover the basis for various positions articulated by the Committee, or the status of certain actions it has taken. Seldom are the Examiners of record, who are mere signatories to the Committee's handiwork, or their immediate supervisors, able to give any useful guidance on those subjects, either because they have no authority to do so and cannot divulge who does or, in some cases, they do not know who even has custody of the patent file so as to investigate the answer to a particular question.

Knowing who is responsible for analyzing the record evidence would also allow Applicant to assess that person's qualifications, as compared to those Ph.D. scientists who have peer reviewed the published experimental evidence confirming lower energy states of hydrogen. Equally important, by knowing who has authority to issue BlackLight's applications, Applicant can more easily ascertain and satisfy the patentability standards being applied in rejecting claims to his novel hydrogen technology.

Illustrating this last point, Applicant attempted to force the Secret Committee to set reasonable standards by which his data could be accepted as reliable proof by requesting the personal Interview that was held on February 21, 2001. Of course, to effectively determine the standards being applied against Applicant, he first had to identify the person(s) responsible for setting those standards.

Applicant, however, was only partially successful in that effort. Prior to the February 21 Interview, Applicant's counsel uncovered the identity of only one Committee member, Examiner Vasudevan Jagannathan, who played a role in rejecting BlackLight's applications. Incredibly, Examiner Jagannathan initially denied any such involvement, accurately noting that his name did not appear anywhere in the record. He therefore refused counsel's explicit request that he attend the upcoming Interview. Only after counsel wrote to a high-level supervisor demanding that Examiner Jagannathan attend did counsel receive confirmation that the Examiner was "directly involved in the creation of the Office Action" to be discussed at the Interview and that he would indeed attend. [See January 19, 2001 letter to Director Esther Kepplinger (Attachment K) and February 12, 2001 letter from Director Jacqueline M. Stone (Attachment N).]

Examiner Jagannathan confirmed his direct involvement by leading the Interview discussions. The Examiner's participation afforded Applicant an opportunity to assess his qualifications to examine and evaluate the experimental evidence of record. Applicant was astonished to hear Examiner Jagannathan basically admit he was unqualified to do so based on several of his comments. One of those comments, as discussed previously, included his characterization of Applicant's highly reliable spectroscopic data confirming lower energy states of hydrogen as a "bunch of squiggly lines."

When pressed for guidance on what standards he used to evaluate Applicant's scientific data and to decide whether to issue his patents, Examiner Jagannathan would not elaborate. Rather, he proposed a new standard requiring Applicant to submit and publish his data in peer-reviewed journal articles before he would give it serious consideration. Despite strenuous objections to this newly minted standard requiring public disclosure of confidential information, Applicant has nonetheless worked diligently to comply with it.

Over the subsequent years, Applicant has used vast resources to present experimental evidence of lower energy states of hydrogen—much of it generated by independent third parties—in over 65 peer-reviewed articles published in the prestigious scientific journals mentioned above. Despite this significant accomplishment, the Committee, true to form, has essentially ignored that published evidence.

Even more impressive, Applicant has successfully met the Committee's new "publication" standard despite the attempts of another BlackLight detractor, Dr. Zimmerman, to undermine that effort by contacting various journals to dissuade them from publishing Applicant's articles. [See Attachment H.] Applicant's discovery of Dr. Zimmerman's latest subterfuge is especially alarming given that the Committee has cited non-peer reviewed statements by him—statements that were posted to an internet bulletin board of all places and that he readily admits are biased—to disparage BlackLight's technology. [See, e.g., Applicant's Response to the Committee's 6/11/03 Office Action filed 12/10/03 in U.S. App'n Ser. No. 09/009,294.]

Aside from the fact that the Committee has relied on such non-peer reviewed materials posted to an internet chat group while, at the same time, requiring that

Applicant's submitted materials be subjected to peer review—a double standard if there ever was one[112]—the Committee shows extreme bias and rather poor judgment in citing material from an arch cynic with a significant vested interest that he is openly protecting. As previously noted, Dr. Zimmerman's proclamations of his efforts to sabotoge Applicant's patent rights are well known. The Committee needs no reminding that Dr. Zimmerman is the former Chief Scientist for the U.S. State Department who published an Abstract of a proposed APS speech boasting how his Department and the Patent Office "have fought back with success" against BlackLight. [See Attachment K, Tab C.] And again, it was Dr. Zimmerman who informed Applicant that his colleague, APS Spokesman, Dr. Park, has communicated with a PTO contact he refers to as "Deep Throat" with access to confidential patent information. [See supra.]

If, as Applicant suspects, the Committee has cooperated with Dr. Zimmerman, or other biased individuals, in denying Applicant his patent rights, while those same individuals have worked behind the scenes to undermine Applicant's compliance with the Committee's concocted publication requirement, then again, that information is highly relevant and should be disclosed without further delay. Such a scenario would be entirely consistent with the Dr. Zimmerman's prior admission proudly proclaiming his success in sabotaging Applicant's patent rights.[113]

Applicant is deeply concerned that the Committee has continued its questionable practice of cooperating with Applicant's competitors, including Dr. Zimmerman and Dr. Park, in thwarting Applicant's patent rights. This concern is only bolstered by its citation

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[112] Not surprisingly, the Committee cannot explain why it required that all materials in support of Applicant's discovery of lower-energy hydrogen be submitted for peer review and publication in qualified scientific journals when biased statements taken from Applicant's competitors are not subjected to the same scrutiny. The Committee's imposition of this obvious double standard merely further highlights the arbitrary and capricious manner in which the Committee has handled this and other BlackLight applications.

[113] Having relied on Dr. Zimmerman's opinion to disparage Applicant's technology, the Committee is constrained to also address the issues raised herein regarding the efforts of Dr. Zimmerman and his APS colleagues—Dr. Park in particular—to sabotage Applicant's patent rights. The Committee's further requirement that Applicant's technology achieve "support in the scientific community" is also affected by Dr. Zimmerman's clandestine activities and, thus, warrants further investigation. In view of this onerous patentablity requirement foisted upon Applicant, anyone who has influence with the Committee should not be using the internet to disparage Applicant's technology and, most certainly, should not be relied upon for his opinions.

to Dr. Zimmerman's non-peer-reviewed, unsubstantiated comments appearing in his paper.[114] [*See, e.g.,* Applicant's Response to the Committee's 6/11/03 Office Action filed 12/10/03 in U.S. App'n Ser. No. 09/009,294.] Prominently displayed on the front page of that paper is the following copyright notice:

> This entire article is copyright 2001 by Peter D. Zimmerman. No forwarding, reposting, copying, excerpting or direct quotation **whatsoever**, even for the purpose of reviews, or storage in any data base or storage system other than the HSG files on Yahoo.com or on the author's personal computer is permitted without the express written permission of the author.

© Peter D. Zimmerman, 2001. All rights reserved. [Emphasis in original.]

Applicant must assume that the PTO, an agency obviously well versed in intellectual property rights, would not have willfully violated the terms of Dr. Zimmerman's copyright notice. Thus, it must be presumed that the agency has been in contact with Dr. Zimmerman, at the very least to secure his permission to reproduce this paper, if not to secure his cooperation in others ways that continue to undermine Applicant's patent rights. Applicant is entitled to know the extent of those contacts and the nature of any communications between the PTO and either Dr. Zimmerman or his colleague Dr. Park.

Applicant is hardly surprised by his inability to break the PTO's code of silence on the suspicious handling of BlackLight's applications given that the PTO is also stonewalling similar inquiries from five U.S. Senators—four of whom requested that Senator Patrick Leahy, Chairman of the Judiciary Committee overseeing the PTO, and/or Commerce Secretary Donald Evans, look into this matter. [See letters to and from Senators Max Cleland, Robert Torricelli, Jon Corzine, Ron Wyden, and Gordon

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[114] Dr. Zimmerman's paper, entitled, "An Analysis of Theoretical Flaws in So-Called Classical Quantum Mechanics and of Experimental Evidence against CQM" has no merit whatsoever. Applicant notes that the Committee has ignored Dr. Mills' extensive rebuttal arguments to Dr. Zimmerman's paper posted in the same internet chat room that Dr. Zimmerman posted his paper. Applicant has provided the Committee with Dr. Mills' rebuttal on numerous occasions, but has yet to receive its response to his arguments, which should given the same level of reliability accorded Dr. Zimmerman's unpublished comments. [See Attachment I.]

Smith (Attachment O).] The PTO's continued refusal to cooperate in response to

Senate inquiries suggests that, perhaps, it has something to hide.[115]

If the PTO looks to the Federal Circuit's June 28, 2002 Decision for license to

continue its unfair and dilatory prosecution through secret examination, it will not find it.

Indeed, Judge Newman, in rationalizing her ruling, incorrectly assumed that the PTO

would fairly and expeditiously prosecute BlackLight's applications:

> Such action must of course be reasonable under the circumstances and
> rare in occurrence, lest the emergency become the rule. But when
> necessary in order to fulfill the PTO's mission, with safeguards to the
> interests of the applicant including fair and expeditious further
> examination, we agree with the district court that the action taken is a
> permissible implementation of the statute and regulation. [See BlackLight
> Power at pages 1537-38 (Attachment B) (Emphasis added).]

Nothing could be further from the truth. As documented by Applicant, the PTO's

prosecution of BlackLight's applications has been nothing short of hostile and its

attempt to hide the mistreatment of Applicant behind the authority of a Secret

Committee only exacerbates the unfairness of those actions and the lack of adequate

safeguards. Worse yet, the Committee's lead examiner, Dr. Souw, now takes an

extreme position that misconstrues the Federal Circuit's June 28, 2002 Decision, and

the underlying D.C. District Court Decision, on a purely procedural issue, i.e., whether

the PTO could properly withdraw an allowed application after payment of the issue fee,

and transforms those cases into rulings on the merits of Applicant's invention that

supposedly support Dr. Souw's § 101 and § 112, ¶1 rejections. [See, e.g., 11/14/05

Office Action filed in U.S. App'n Ser. No. 09/813,792 at 14, 17.] No doubt the Federal

Circuit and District Court Judges who delivered the procedural rulings in those cases

would be surprised to learn that Dr. Souw, who competes with Applicant as President of

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[115] In the PTO's reply to the Senators' inquiry letters, Robert L. Stoll, Administrator for External Affairs, contended that any comments in response to those inquiries would be "inappropriate" because of the then-pending appeal to the Federal Circuit in BlackLight Power Inc. v. Dickinson, Civ. No. 00-0422 (D.D.C). [See Attachment O.] Putting aside the fact that the issues then on appeal had absolutely nothing to do with the points of inquiry, this contrived excuse has gone stale as the Federal Circuit decided that case many years ago in June 2002. [See Attachment B.] By its own statements, nothing now prevents the PTO from cooperating with the U.S. Senate regarding the administrative irregularities brought to its attention.

BMS Enterprise while examining his pending patent applications, would proffer such a blatant mischaracterization.

Because this untenable situation has failed to provide the safeguards to the interests of Applicant, including the fair and expeditious further examination contemplated by the Federal Circuit in its Decision, Applicant has herein requested an equitable remedy that the PTO immediately issue all five of the withdrawn BlackLight applications that gave rise to that Decision. [See Demand for Information and Redress, *infra*.]

Applicant strongly urges the PTO to break its silence and to engage in an open and honest discussion of these issues that continue to plague the examination of BlackLight's pending applications. To this end, Applicant renews his earlier offer, as expressed in Dr. Brewer's December 21, 2001 letter, to meet with the PTO Director and/or any other government officials, anywhere, anytime, to resolve these outstanding issues. Applicant sincerely hopes that the Director will likewise commit himself to achieving the same objective so that a fair and expeditious prosecution of all of BlackLight's applications that safeguards Applicant's interests, as envisioned by the Federal Circuit, can be achieved with mutually beneficial results.

Part of that forward movement should include a complete and proper consideration of Applicant's overwhelming experimental evidence confirming the utility and enablement of Applicant's novel hydrogen technology. In view of that evidence, Applicant submits that the rejections under 35 U.S.C. §§ 101 and 112 are misplaced and should be withdrawn, and that the present application is in condition for allowance.

Discussions Held And Agreements Reached
During The February 11, 2003 Interview

The above-mentioned problems associated with the Secret Committee's examination of this and other BlackLight applications can be summarized as follows based on its failure to:

(1) identify all persons from within and outside the Patent Office who contributed to, or were otherwise involved in, withdrawing or rejecting BlackLight's applications;

(2) identify those persons having ultimate authority to analyze the vast body of experimental evidence demonstrating the existence of lower energy states of hydrogen and, based on that analysis, for deciding whether to issue patents on Applicant's novel hydrogen technology;

(3) establish and apply consistent patentability standards and guidelines by which that patentability decision is to be made; and

(4) properly analyze the evidence of record—now published, or to be published, in over 65 peer-reviewed journal articles—that the Committee required Applicant to submit.

The Committee merely perpetuated those failures in its previous Office Actions by dismissing, without serious analysis, Applicant's submitted data evidencing lower energy states of hydrogen. Frustrated by the Committee's inaction, but still determined to get a fair and expeditious hearing, Applicant requested and received the courtesy of another personal Interview, held February 11, 2003, to present his evidence and to discern the standards by which the ultimate decision-maker would be evaluating it.[116]

To that end, Applicant repeatedly requested that Examiner Jagannathan attend the Interview, since he had led the prior Interview held February 21, 2001, and, despite attempts to keep his identity secret, he was the only person known at the time to have been directly involved in creating the substantive Office Actions of record. Specifically, Applicant sought to question Examiner Jagannathan on why he still refused to accept Applicant's scientific data evidencing lower-energy hydrogen after it had been published, or was soon to be published, in what was then over 40 (now over 65) peer-reviewed journal articles, which he himself had required. Applicant, however, never got the chance to pose that question. Without explanation, Examiner Jagannathan refused to attend the Interview, just as he had refused to attend the Interview held two years earlier—only this time, he did not show up.

Applicant also requested that Examiners Wayne Langel and Stephen Kalafut attend the Interview, since they had previously allowed the five BlackLight applications

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[116] Although the Interview Summary does not specifically list the serial number of all BlackLight applications as being the subject of the February 11, 2003 Interview, Examiners Langel and Kalafut agreed beforehand that the Interview would be held to address the similar rejection of claims in all assigned BlackLight cases based on an alleged lack of utility and inoperability.

that were mysteriously withdrawn from issue and their names were the only ones appearing in the record as signers of the substantive Office Actions under consideration. Examiners Langel and Kalafut did appear for the Interview, together with their immediate supervisors, SPE's Patrick Ryan and Stanley Silverman. Examiner William Wayner, who was assigned to one BlackLight application prior to his retirement from the PTO and who expressed an interest in attending the Interview, also appeared.

Also attending the Interview and leading the discussions on the PTO's behalf was Quality Assurance Specialist Douglas McGinty, who until that time had never been identified to Applicant as having played any role in the examination of his applications.

Attending the Interview on behalf of BlackLight Power were the inventor, Dr. Randell L. Mills, his counsel, Jeffrey S. Melcher and Jeffrey A. Simenauer, and company Director Dr. Shelby Brewer.

Also attending the Interview as an observer at Applicant's request was Ted C. Liu, Senior Legislative Assistant for Congressman David Wu, who represents the 1st District of Oregon.

During the Interview, Applicant made a sincere effort to advance the prosecution of his applications and to find common ground upon which all of these cases, once again, would be allowed to issue as patents. Applicant believed it was a worthwhile effort in light of Examiner Langel's statements on the record reaffirming his consistent view that Applicant's novel hydrogen technology is fully operable and, therefore, entitled to patent protection. The Interview was also significant in view of the following representations and agreements that resulted from the discussions between Applicant and lead-Specialist McGinty:

(1) Applicant will identify the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties;

(2) the Examiners whose signatures appear on the rejections of record, i.e., Examiners Langel, Kalafut, and Wayner, have full authority to review that data and, based on their review, to issue patents as deemed appropriate; and

(3) Applicant will confer with the signatory Examiners, either by telephone or in person, to review each assigned application on a claim-by-claim basis to ensure that the scientific data presented adequately supports the scope of the

claims. For those claims determined to be adequately supported by the data, a patent will issue. For any claims deemed to be inadequately supported, Applicant reserves the right to continue seeking that broader claim coverage in subsequent proceedings.

Applicant appreciated the guidance Specialist McGinty provided during the Interview for securing BlackLight's patents. Based on that guidance, Applicant presented comments in two pending applications for which Responses were due detailing the substance of discussions held at the Patent Office on February 11th and identifying the independent, third-party data per agreement (1) above, which information is reproduced below. [U.S. App'n Ser. Nos. 09/110,678 and 09/362,693.]

Applicant's comments confirmed Examiner Langel's long-held view that the claims in those cases were in condition for allowance. Applicant therefore requested that Examiner Langel exercise his authority to issue a Notice to that effect per agreement (2) above so that patents could then be issued.

Following up on the Responses filed in those pending applications per agreement (3) above, Applicant arranged for an Interview with Examiner Langel to review the cases on a claim-by-claim basis to ensure that the scientific data presented adequately supported the scope of the claims in those cases. In fact, Applicant and Examiner Langel reached a tentative understanding that certain claims were adequately supported by the data and that Applicant was therefore entitled to his patents.

Unfortunately for Applicant, that understanding was short lived after Examiner Langel, "for moral and ethical reasons," agreed under the most grievous of circumstances to his removal from examining all BlackLight applications to which he was assigned. Applicant was dismayed to further learn from Examiner Langel that the PTO has adopted an "allowance is not an option" policy with respect to all pending BlackLight applications. Before discussing the prejudicial ramifications of these unfortunate incidents, however, Applicant presents the following recap of the

discussions held during the February 11, 2003 Interview that lead to the above agreements.[117]

Just prior to the Interview, Specialist McGinty asked that Mr. Liu speak by telephone with Talis Dzenitis, a Congressional Affairs Specialist in the PTO's Legislative and International Affairs Office, to discuss his reasons for attending. Mr. Liu explained to Specialist Dzenitis that a constituent associated with BlackLight had contacted Congressman David Wu complaining of the irregular procedures the PTO has used in examining the company's pending patent applications. The procedures complained of included the PTO's withdrawal of the five applications approved by Examiners Langel and Kalafut for issuance as patents and the subsequent rejection of those and other BlackLight applications by an unknown group of PTO officials referred to by Applicant as a "Secret Committee."

Specialist Dzenitis represented to Mr. Liu that no such secret committee existed at the Patent Office. Applicant was surprised by that representation considering that a group of anonymous PTO officials were known to be handling BlackLight's applications and drafting the substantive Office Actions that the Examiners of record were instructed to sign.

Examiner Langel confirmed as much in an extended discussion he had with Mr. Liu and Applicant's counsel following the formal phase of the Interview. During that discussion, Examiner Langel repeated his prior denials of having authored the substantive Office Actions of record in the BlackLight applications to which he was assigned, even though those Actions bear his signature. Examiner Langel also repeated his previously expressed views that Applicant is entitled to patents on his novel hydrogen technology and that he wanted to issue those patents. Examiner Langel explained, however, that other PTO officials unknown to him having higher authority were responsible for drafting the substantive Office Actions he signed and for deciding whether to issue Applicant his patents.

The only person Examiner Langel could identify for Mr. Liu as "having something to do with the Office Actions" was Examiner Jagannathan, whose name does not

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[117] Much of the substance of these discussions was confirmed in e-mail correspondence between Mr. Liu and Applicant's Counsel. [See Attachment P.]

appear on any Office Action. As noted above, Examiner Jagannathan kept his identity a secret from Applicant until counsel exposed his direct involvement in creating the Office Actions of record and forced him to attend the prior Interview that he led on February 21, 2001. [See January 19, 2001 letter to Director Esther Kepplinger (Attachment K) and February 12, 2001 letter from Director Jacqueline M. Stone (Attachment N).] When the recent February 11, 2003 Interview started, it was Specialist McGinty, another previously unidentified PTO official, who led the discussion.

Following the telephone conversation with Specialist Dzenitis, in which he denied the existence of a secret committee, Mr. Liu joined the Interview already in progress. Applicant began the Interview with a general discussion of his novel hydrogen technology and a presentation of the experimental evidence confirming its operation and utility. Specifically, Applicant explained to the PTO officials in attendance how independent laboratory studies, including those conducted by a leading Los Alamos researcher and by a NASA funded group, as well as other highly reliable scientific data, demonstrate the existence of lower energy states of hydrogen underlying his technology.

At no time during Applicant's presentation did the PTO officials analyze or otherwise address to any significant degree the merits of that data proving the existence of lower-energy hydrogen. Rather, these officials—with the exception of Examiner Langel—raised non-technical arguments, similar to those raised in the pending Office Actions, why lower-energy hydrogen could not exist and, thus, why they were justified in according the real-world data little or no weight.

The first such argument, raised by Examiner Wayner, was based on unrelated technologies that have been subjected to ridicule in the scientific community, such as perpetual motion, cold fusion, and 100-miles-per-gallon carburetors. Examiner Wayner compared those controversial technologies to BlackLight's novel hydrogen chemistry and then asked Applicant: "How is your invention any different?"

Applicant pointed out significant differences. Unlike the far-fetched inventions mentioned by Examiner Wayner, Applicant explained that his inventions have been actually reduced to practice, as demonstrated by the many working prototype energy cells developed over the past ten years and the novel chemical compounds produced

by the process, which were made available to the PTO in the past and again during the Interview. In fact, Applicant invited the PTO officials to visit his laboratory in Cranbury, New Jersey at his expense and to witness the operation of his energy cells for themselves, but like prior invitations, this one too was ignored.[118]

Applicant further distinguished his claimed inventions based on the substantial body of experimental evidence that corroborates the existence of lower energy states of hydrogen. Again, none of the PTO officials who raised non-technical arguments questioning the operability of Applicant's novel hydrogen technology made any real attempt to analyze that corroborating evidence. Indeed, Examiner Wayner frankly admitted that his background was in mechanical engineering and, therefore, he was not qualified to conduct such an analysis.

Examiner Wayner also questioned why, if BlackLight's technology was such an important discovery, the company had not yet developed a commercial device for producing energy. Applicant explained that the high cost of developing commercial products was an impediment and that, because BlackLight was not well-suited to undertake such development, it was looking to license patents on its technology to other companies to commercially exploit that technology.

Concerned that Examiner Wayner might be introducing yet another new patentability standard, requiring the sale of a commercial product, counsel pressed the Examiner on whether that was his intention. Examiner Wayner plainly stated it was not and, in response to a specific question from Mr. Liu, affirmed that Applicant need not prove commercial applicability to secure a patent for his invention.[119]

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[118] Dr. Shelby Brewer, a BlackLight Director and former Assistant Secretary of Energy in the Reagan Administration, first invited PTO officials to visit BlackLight's laboratory in Cranbury, New Jersey to "witness first hand our working prototypes of Dr. Mills' energy cell and his assortment of novel hydride compounds exhibiting unusual properties" in his December 21, 2001 letter addressed to then-Director James E. Rogan. [Attachment A] Although the PTO has been frequently reminded of this open invitation, it has stubbornly refused to accept or even acknowledge it.

[119] Despite these assurances, Applicant is proceeding under the assumption that the PTO is requiring proof of commercial viability before it will issue him any patents on his novel hydrogen technology, especially in light of his discovery that the Committee now takes the position that "allowance is not an option" in BlackLight's cases. [See infra.] Issuance of Applicant's patents, however, should not be delayed while awaiting his own commercial development of that technology, especially now that Applicant has learned that at least one foreign company is nearing introduction of a product based on Applicant's lower-energy hydrogen technology into the U.S. market. Applicant is entitled to his patents to exclude

Applicant also became alarmed when Examiner Wayner, in referring generally to BlackLight's "detractors," invoked only the name of APS lobbyist and spokesman Dr. Robert Park as someone who disputes the existence of lower energy states of hydrogen.[120] Applicant's counsel wanted to raise issues relating to Dr. Park's "Deep Throat" contact in the Patent Office and his reputation for conducting "hatchet jobs" on new technologies that threaten his lobbying of hundreds of millions of dollars on behalf of the APS to federally fund its pet projects. [See *supra*.] Specialist McGinty, however, cut counsel off, refusing to discuss the matter. When Specialist McGinty suggested that BlackLight has a "similar agenda," noting its recent NASA contract, Applicant corrected him, explaining that BlackLight does not receive any government funding for its research. Specialist McGinty had no response and the discussion moved onto other, less controversial subjects.

Examiner Wayner raised other issues regarding the reliability of the scientific evidence presented by Applicant. That evidence included spectroscopic data, which counsel described as being equivalent to a "chemical fingerprint." Counsel further noted that Dr. Park himself, whom Examiner Wayner identified as BlackLight's chief antagonist, has proclaimed the extraordinary reliability of spectroscopic data. [See *supra*.]

Yet when Applicant tried to present this highly reliable spectroscopic data at the Interview showing the spectral lines corresponding to lower-energy hydrogen, *i.e.,* a "hydrino" state, Examiner Wayner interrupted, commenting that "spectroscopic lines are meaningless" and "don't mean a hill of beans" to him. That comment was reminiscent

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that company and others from commercially exploiting that technology absent the payment of royalties that would be due under those patents.

[120] To Applicant's astonishment, in the Office Actions issued in Examiner Wayner's one assigned case, the Committee has continued to cite Dr. Park's biased statements against Applicant as a basis for rejecting claims in this case:

> The opinion of Robert Park set forth in the Examiner's action of 4/14/00, paper #16. i.e. "But according to the country's leading organization of academic physicists, Mills' hydrino theory has no credibility. "There is virtually nothing that science does not know about the hydrogen atom," said Robert Park, director of the Washingtong [sic] office of the American Physical Society. "The ground state is defined as the (energy) state below which you cannot go ... the thought there is some state below the ground state is kind of humerous [sic]." [See 4/26/04 Office Action at p. 4 in U.S. App'n Ser. No. 09/181,180.]

of a previous one by Examiner Jagannathan characterizing Applicant's spectroscopic data as "a bunch of squiggly lines." [See *supra*.]

Counsel again became concerned that BlackLight's applications were being evaluated using rather loose patentability standards. Counsel therefore requested that the PTO officials provide some guidance regarding the evidentiary requirements they were imposing on Applicant. Specialist McGinty and Examiner Wayner at first did not respond directly to Counsel's request for guidance, but rather began questioning the accuracy of the test data Applicant submitted to confirm the existence of lower energy hydrogen.

Applicant explained that the submitted test data was generated by highly qualified Ph.D. scientists, many of whom represent independent laboratories. Applicant further noted how this data had been extensively peer-reviewed in the 40-plus (now over 65) articles published, or soon to be published, in prestigious scientific journals, including the *Journal of Applied Physics*. Applicant also provided Specialist McGinty— much to his surprise—with specific data showing the lower-energy state spectral lines that were published in the prestigious spectroscopic publication, *Journal of Molecular Structure*.

Applicant was astounded by the refusal of Specialist McGinty and Examiner Wayner to accept the reliability of the scientific data appearing in these published journal articles, especially considering the PTO's routine acceptance of evidence submitted in printed publications to overcome utility rejections. See, *e.g.*, MPEP § 2107.01 (VI) pp. 2100-33 ("An applicant can [submit evidence in response to a utility rejection] using any combination of the following: amendments to the claims, arguments or reasoning, or new evidence submitted in an affidavit or declaration under 37 CFR 1.132, or in **a printed publication**." (emphasis added)).

Counsel also reminded the PTO officials of the standard imposed by lead-Examiner Jagannathan during the previous Interview held February 21, 2001 that conditioned his consideration of evidence of lower-energy hydrogen on its publication in peer-reviewed journal articles based on the reliability of the peer-review process. Counsel then noted once again that, despite Examiner Jagannathan's failure to provide legal authority for imposing this unreasonable standard, Applicant had not only met it,

but had exceeded it with over 40 (now over 65) journal articles. Having done so, counsel expressed extreme frustration with the PTO's continued refusal to seriously analyze the published scientific data based on manufactured excuses, such as this newly concocted one concerning the accuracy of Applicant's data.

Specialist McGinty raised yet another weak excuse for ignoring the published data by asking what assurances Applicant could provide that the journal articles had been actually peer reviewed! Mystified by that question, Applicant could only state what is a simple known fact: to get scientific data published in a journal article, it must first go through a rigorous peer-review process. Indeed, many of Applicant's articles went through numerous drafts and required further experimentation as directed by the Ph.D. scientists who peer reviewed those articles.

At that point in the Interview, Specialist McGinty admitted that, like Examiner Wayner, he was not qualified to analyze the published data. Applicant was surprised by that admission, since the Interview was being led by Specialist McGinty and had been arranged for the express purpose of presenting the experimental evidence of record.

Examiner McGinty's admission merely fueled Applicant's prior concerns that his published scientific data was not being properly considered, prompting counsel to ask who was responsible for analyzing that data. Specialist McGinty replied by stating that Examiners Langel and Kalafut, the Examiners of record, had that responsibility. That too came as a surprise since Examiners Langel and Kalafut were the ones who had originally reviewed Applicant's experimental evidence in allowing the five BlackLight applications that were subsequently withdrawn from issue. Applicant, however, was relieved to learn that these two Examiners, who had over 50 years of experience between them and who were obviously qualified to analyze the published data, were being reassigned that task.

Counsel then addressed the vexing problem of constantly changing patentability standards that had been plaguing the examination process. Counsel specifically mentioned, for example, the prior Office Actions that claimed Applicant's lower-energy hydrogen technology violated known laws of physics and chemistry without specifically identifying even one such law, and then required Applicant to prove otherwise.

Counsel also cited a recent Office Action dismissing Applicant's scientific data out of hand for failing to prove the invalidity of quantum theory:

> The request for reconsideration has been entered and considered but does not overcome the rejection . . . because there is no evidence presented which would prove applicant's contention that the theory of quantum mechanics is invalid." [October 7, 2002 Advisory Action entered in U.S. Serial No. 09/110,717.]

When Specialist McGinty accused Applicant of putting a "spin" on the Examiner's rejection, counsel noted that he had been reading the above quotation directly from the Office Action.

Counsel also mentioned other recent Office Actions filed in BlackLight cases that dismissed Applicant's recent submission of peer-reviewed journal articles, in accordance with the standards imposed by Examiner Jagannathan, as being merely "cumulative" when it clearly was not and even the originally submitted evidence had not been properly analyzed.

Expressing frustration over the PTO's failure to provide any consistent patentability standards to guide Applicant, counsel once again requested that Specialist McGinty provide such guidance. Specialist McGinty again raised concern over the integrity of the experimental evidence, but indicated that he would be more receptive to that evidence if it was validated by independent third parties.[121]

Applicant explained to Specialist McGinty that much of the evidence submitted over the previous four years was, in fact, generated by independent third parties. Applicant then began citing examples of the extensive independent third-party evidence disclosed in publications previously cited to the PTO, as well as more recently generated evidence that was subsequently submitted.[122] Specialist McGinty did not

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[121] Just as Specialist McGinty sought assurances at the February 11 Interview that persons involved in generating and furnishing the scientific data submitted by Applicant are independent and unbiased, Applicant deserves similar assurances that those involved in rejecting BlackLight's applications are also independent and unbiased. Despite Applicant's repeated requests for such assurances, none have been given. The genuine conflicts of interest uncovered by Applicant involving Examiner Souw and his clearly biased views against BlackLight adopted by the Committee merely underscore the importance of this highly relevant information.

[122] See R. L. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", Int. J. Hydrogen Energy, Vol. 26, No. 9, (2001), pp. 965-979.

respond, whereupon counsel noted that the PTO's unfounded concern that the record evidence lacked third-party validation merely demonstrated its failure to thoroughly analyze that evidence.

Further demonstrating a lack of familiarity with the record evidence, Specialist McGinty criticized Applicant's experimental evidence as a whole by referring numerous times to only high-power plasma data. Applicant repeatedly pointed out that the plasma data was but a small fraction of the submitted evidence and that it was presented primarily to provide additional support for his plasma-related applications.

Applicant noted that the vast body of other scientific data he submitted relates to a broad range of analytical studies demonstrating the existence of lower energy states of hydrogen. For example, regarding those applications relating to novel chemical compounds, Applicant pointed Specialist McGinty to the extensive spectroscopic data supporting the identification of those compounds. Specialist McGinty, however, apparently did not understand the significance of that data, stating that the NMR data confirming lower-energy hydrogen could have been due to nitrogen. Applicant had to explain that, as a matter of basic scientific knowledge, NMR data only shows protons and that no other element but hydrogen is in the data range. Applicant also explained that the NMR data confirms the presence of an internal energy source.

Knowing that highly qualified Examiners Langel and Kalafut were once again responsible for analyzing the published data was reassuring. There still remained, however, one nagging issue, namely, who had the ultimate authority to issue Applicant his patents. Counsel expressed concern that the pending applications were being examined in secret and that, without knowing who had that authority, Applicant was being unfairly denied an opportunity to present his case to the actual decision-maker.

R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J. Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.

J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat in 'Resonance Transfer' Plasmas", Journal of Applied Physics, submitted.

A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002, http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf.

Specialist McGinty then stated in no uncertain terms that Examiners Langel, Kalafut, and Wayner, the signers of the Office Actions under consideration, had "full authority" to examine the pending applications and to issue the patents.

Upon hearing that statement, counsel immediately turned to Examiner Langel and asked him point blank whether, after having studied the experimental evidence of record, he still believed that BlackLight's patent applications were allowable. The Examiner replied in no uncertain terms, "Yes, they're still allowable."

Counsel then asked Examiner Langel whether he was prepared to immediately allow the claims and issue Applicant his patents in those applications assigned to him, as is customary during an Interview, to which the Examiner replied, "Fine with me."

Specialist McGinty, however, expressed uneasiness over Examiner Langel's agreement to allow claims at the Interview. Specifically, he stated his concern that even if Applicant's claimed technology were found to be operable, there were still issues of novelty and nonobviousness to be addressed before a patent could be issued.

Counsel was surprised by that statement given the PTO's arguments over the prior three years that Applicant's inventions were inoperable based on an incorrect assumption that lower-energy hydrogen cannot possibly exist. Counsel pointed out the obvious contradiction in arguing that the Examiners may still need to conduct a prior art search for possible disclosure of Applicant's lower-energy hydrogen technology.

Counsel further noted the PTO's own examination guidelines requiring Examiners to evaluate the operability and utility of a claimed invention together with its novelty and nonobviousness following a complete prior art search. See MPEP § 706.[123] Counsel again turned to Examiner Langel to confirm whether that was his understanding. The Examiner replied that it was and indicated that, in fact, the first

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[123] MPEP § 706 provides in pertinent part:

> After the application has been read and the claimed invention understood, a prior art search for the claimed invention is made. With the results of the prior art search, including any references provided by the applicant, the patent application should be reviewed and analyzed in conjunction with the state of the prior art to determine whether the claims define a useful, novel, nonobvious, and enabled invention that has been clearly described in the specification. The goal of examination is to clearly articulate any rejection early in the prosecution process so that the applicant has the opportunity to provide evidence of patentability and otherwise reply completely at the earliest opportunity.

thing he did was to conduct a thorough prior art search because he thought that might be the easiest way to dispose of the applications assigned to him. Examiner Langel explained, however, that he was unable to reject the applications on prior art grounds, which was why he originally allowed them.

Counsel acknowledged Specialist McGinty's hesitance to issue Applicant patents covering his claims at the Interview and assured him that Applicant wanted to work with him to remove any lingering concerns. Counsel then specifically asked Specialist McGinty to articulate how they might proceed in trying to accomplish that mutually beneficial goal. In response, Specialist McGinty indicated that, in the next Response to any pending or subsequent Office Actions, Applicant should focus on identifying the scientific data generated by independent third-party testing, as opposed to test data generated solely by Applicant. Counsel agreed to do that.

Specialist McGinty further expressed concern over whether that scientific data, even if assumed to be reliable, was commensurate with the scope of the claims of the various applications to adequately support patentability. Counsel stated that Applicant's data did adequately support the claimed subject matter. Counsel, however, recommended reviewing the claims of each application one by one with the assigned Examiners to see if at least some agreement could be reached as to those claims that are adequately supported and for which patents can be issued. As for any remaining claims that the Examiners believe are not adequately supported by the scientific data, Applicant would be free to seek such broader claim coverage through continued prosecution.

Specialist McGinty agreed that this was a reasonable way to proceed and granted a request by counsel, Mr. Simenauer, that this agreement be memorialized in writing in an attachment to the Interview Summary Form. Mr. Simenauer offered to draft this agreement, as is common practice, and Specialist McGinty enthusiastically accepted the offer. Mr. Simenauer then drafted the following Attachment as Specialist McGinty looked on:

ATTACHMENT TO INTERVIEW SUMMARY FORM

Applicant requested that the following points discussed at the Interview held on February 11, 2003 be included as an Attachment to the Interview Summary Form.

Applicant's counsel and the Examiners in attendance at the Interview agreed to meet again at a future date, either in person or by telephone, to continue discussions regarding the patentability of Applicant's pending patent applications. Specifically, the Examiners expressed concern that Applicant's experimental evidence be commensurate with the scope of the claims. To address that concern, Applicant's counsel agreed with the Examiners to go through the patent applications claim-by-claim with the Examiners and demonstrate how the scientific data supports those claims.

For those claims that are supported by the data, the PTO agrees to issue those claims. For those claims that the PTO determines are not supported by the data, Applicant will continue to seek that broader claim coverage in subsequent proceedings. [Attachment F]

After completing the two-page handwritten Attachment, Mr. Simenauer read it out loud in the presence of Specialist McGinty and Examiner Langel so that they could confirm its accuracy and make any necessary changes. When asked by counsel whether they were satisfied with the wording of the Attachment, Specialist McGinty stated that he was, as did Examiner Langel, who then signed each of the two pages. There was absolutely no confusion as to the agreement to issue patents for those claims found to be supported by the scientific data.

Incredibly, in a transparent attempt to rewrite history, some unknown PTO official apparently instructed Examiner Langel to sign a subsequent communication mailed over two weeks later, on February 26, 2003, that included an attached "Supplement to Interview Summary" (Attachment F), which provides in pertinent part:

The following is a supplement to the summary concerning the February 11, 2003 interview re 09/501,622, etc. . . . A two-page Interview Summary was provided by Examiner Langel. A two page "Attachment to Interview Summary Form" also was provided by Mr. Simenauer. While the Attachment may represent the applicant's understanding of the interview, two points must be clarified.

First the second page of the applicant's attachment states in part: "for those claims that are supported by the data, the PTO agrees to issue those claims." The PTO made no such agreement. Instead, the PTO representatives indicated

that the rejections under both 35 USC 101 and 112, 1st para., are outstanding and that evidence as to verification by credible, established, independent third parties would carry more persuasive weight.

Second, QAS Douglas McGinty was not listed in the Examiner's Interview Summary. He was present during the interview with the aforementioned attendees.

[signed]   Wayne Langel
Primary Examiner
Art unit 1754

If PTO officials wanted to retract one of the key agreements reached at the Interview, they should have expressly said so, identifying who made the decision and giving reasons for the retraction. Since this was not done, Applicant has no choice but to rely on the accuracy of the contemporaneous written record.

Moreover, in view of other agreements reached at the Interview, the suggestion that there was no agreement to issue patents under the stated conditions is absurd— though hardly surprising given the sordid prosecution history of BlackLight's patent applications. Specialist McGinty plainly stated on the record that the Examiners who signed the outstanding rejections have full authority to review the data and to issue Applicant his patents. Also of record is Examiner Langel's unequivocal statement that, based on his review, he was prepared to issue those patents. To then force this same Examiner to sign a statement two weeks after the fact denying that "for those claims that are supported by the data, the PTO agrees to issue those claims" is, frankly, embarrassing.

Other ineffective arguments, such as those made by Examiner Kalafut that "the present Examiner did not commit to any agreements during the interview," are also disappointing and, hopefully, will not be repeated. [See Advisory Action dated April 2, 2003 filed in U.S. App'n Ser. No. 08/467,911.] Applicant acknowledges that, to the best of his recollection, Examiner Kalafut, although present at the February 11 Interview, did not speak a word. As previously indicated, it was Specialist McGinty who led the Interview on behalf of the PTO and it was he who ultimately agreed to the terms under which examination of BlackLight's patent applications would proceed, which terms were expressly reduced to writing. For Examiner Kalafut, or any other Examiner assigned to

one of BlackLight's applications, to now attempt to distance themselves from that agreement based on the weak assertion that they did not personally commit to it during the Interview merely illustrates yet another example of the PTO's arbitrary and capricious approach to examining these applications.

Applicant's Identification of Scientific Data Supporting Lower energy States of Hydrogen Generated and Furnished By Independent Third-Parties

In light of the controversial prosecution history of this and other pending BlackLight cases, Applicant appreciated what seemed to be Specialist McGinty's willingness to set reasonable standards and guidelines by which Applicant's patents could finally be issued. Applicant acknowledged and documented Specialist McGinty's concern over the reliability of the record evidence, which led to his requirement that Applicant identify independent third-party verification of the scientific data as noted in the PTO's Supplement to Interview Summary. With those standards and guidelines in mind, Applicant presented in two pending applications a summary of the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties, which data is reproduced below along with additional, newly submitted data.[124]

Experimental Evidence Generated by Independent Third Parties

Applicant is unaware of any statutes, rules, or case law requiring that experimental evidence submitted by an Applicant in response to a rejection by the PTO be generated by independent third parties. Despite the higher standard imposed by Specialist McGinty requiring such third-party validation of the evidence, Applicant still has met and far exceeded this standard as shown below.

Applicant provides the following alphabetical list of independent third-party laboratories and universities that conducted the experiments and generated the scientific data relied upon and discussed in the analytical studies that follow this list:

Advanced Research - Pirelli Labs, Milan, Italy

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[124] See U.S. App'n Ser. Nos. 09/110,678 and 09/362,693.

Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base

Atomic Energy Canada Limited, Chalk River Laboratories

Brookhaven National Laboratory

Charles Evans & Associates, Sunnyvale, CA

Charles Evans East, East Windsor, NJ

Environmental Catalysis and Materials Laboratory of Virginia Polytechnic Institute

Franklin and Marshall College

Galbraith Laboratories, Inc., Knoxville, TN

Grace Davison, Columbia, MD

IC Laboratories, Amawalk, NY

Idaho National Engineering Laboratory

Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany)

Jobin Yvon Inc., Edison, NJ

Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER)

Liebert Corporation, Division of Emerson Corporation

Los Alamos National Laboratory

Material Testing Laboratory, Pennington, NJ

MIT Lincoln Laboratories

Moscow Power Engineering Institute

NASA Lewis

National Research Council of Canada

PacifiCorp

Pennsylvania State University Chemical Engineering Department

Perkin-Elmer Biosystems, Framingham, MA

Pirelli Labs, Milan, Italy

Ricerca, Inc., Painesville, Ohio

Rider University, Lawrenceville NJ

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel

Ruhr University, Bochum, Germany

Shrader Analytical & Consulting Laboratories

Spectral Data Services, Inc., Champaign, IL

S. S. W., University of Western Ontario, Canada

Surface Science Laboratories, Mountain View, CA

Thermacore, Inc., Lancaster, PA

University of Delaware, Wilmington, DE

University of Massachusetts Amherst, Amherst, MA

University of New Mexico

Westinghouse Electric Corporation

Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA

The following 51 abstracts briefly describe the analytical studies of the scientific data generated by these independent third parties (highlighted in <u>underline</u>).

Independent Test Results

51. **J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies of line broadening in catalysis plasmas. This is the third in a series of papers by our team on apparently anomalous Balmer series line broadening in hydrogen containing RF generated, low pressure (< 600 mTorr) plasmas. In this paper the selective broadening of the atomic hydrogen lines in pure H2 and Ar/H2 mixtures in a large "GEC" cell (36 cm length X 14 cm ID) was mapped as a function of position, H2/Ar ratio, time, power, and pressure. Several observations regarding the selective line broadening were particularly notable as they are unanticipated on the basis of earlier models. First, the anomalous broadening of the Balmer lines was found to exist throughout the plasma, and not just in the region between the electrodes. Second, the broadening was consistently a complex function of the operating parameters particularly gas composition (highest in pure H2) position, power and pressure. Clearly not anticipated by earlier models were the findings that under some conditions the highest concentration of "hot" (>10 eV) hydrogen was found at the entry end, and not in the high field region between the electrodes and that in other conditions, the hottest H was at the (exit) pump (also grounded electrode) end. Third, excitation and electron temperatures were less than one eV in all regions of the plasma not directly adjacent (>1mm) to the electrodes, providing additional evidence that the energy for broadening, contrary to standard models, is not obtained from the field. Fourth, in contrast to our earlier studies of hydrogen/helium and water plasmas, we found that in some conditions 98% of the atomic hydrogen was in the "hot" state throughout the GEC cell. Virtually every operating parameter studied impacted the character of the hot H atom population, and clearly second and third order effects exist, indicating a need for experimental design. Some non-field mechanisms for generating hot hydrogen atoms, specifically those suggested by Mills' CQM model, are outlined.

50. **J. Phillips, C. K. Chen, R. Mills, "Evidence of the Production of Hot Hydrogen Atoms in RF Plasmas by Catalytic Reactions Between Hydrogen and Oxygen Species", Journal Plasma Physics, submitted.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies of line broadening in catalysis plasmas. Selective H-atom line broadening was found to be present throughout the volume (13.5 cm ID x 38 cm length) of RF generated H_2O plasmas in a GEC cell. Notably, at low pressures (ca. <0.08 Torr), a significant fraction (ca. 20%) of the atomic hydrogen was 'hot' with energies greater than 40 eV with a pressure dependence, but only a weak power dependence. The degree of broadening was virtually independent of the position studied within the GEC cell, similar to the recent finding for He/H_2 plasmas in the same GEC cell. In contrast to the atomic hydrogen lines, no broadening was observed in oxygen species lines at low pressures. Also, in 'control' Xe/H_2 plasmas run in the same cell at similar pressures and adsorbed power, no significant broadening of atomic hydrogen, Xe, or any other lines was observed. Stark broadening or acceleration of charged species due to high electric fields can not explain the results since i) the electron density was insufficient by orders of magnitude, ii) the RF field was essentially confined to the cathode fall region in contrast to the broadening that was independent of position, and iii) only the atomic hydrogen lines were broadened. Rather, all of the data is consistent with a model that claims specific, predicted, species can act catalytically through a resonant energy transfer mechanism to create 'hot' hydrogen atoms in plasmas.

49. **R. L. Mills, Y. Lu, B. Dhandapani, "Spectral Identification of $H_2(1/2)$", submitted.**

Lower-energy molecular hydrogen lines were independently recorded and interpreted by Stephan Fuelling of the University of Nevada, Reno and the Nevada Terawatt Facility and provided to BlackLight. Novel emission lines with energies of $q \cdot 13.6\, eV$ where $q = 1,2,3,4,6,7,8,9,$ or 11 were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2%

hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein $n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p}$; ($p \leq 137$ is an integer) replaces the well known parameter

n = integer in the Rydberg equation for hydrogen excited states. Evidence supports that these states are formed by a resonant nonradiative energy transfer to He^+ acting as a catalyst; whereas, krypton, xenon, and their ions serve as controls. Two $H(1/2)$ may react to form $H_2(1/2)$ with emission of the bond energy from a resonant state within its transition state with vibration-rotational energies that are the same as those of H_2. A series of vibration-rotational bands in the 60-67 nm region, a high-energy region for which vibration-rotational spectra are ordinarily unknown, was observed from low-pressure helium-hydrogen (99/1%) microwave plasmas that matched the predicted energy spacing of the vibrational energy of H_2 about the bond energy of $H_2(1/2)$ corresponding to the reaction $2H(1/2) \rightarrow H_2(1/2)$.

48. **J. Phillips, C. K. Chen, T. Shiina, "Evidence of Catalytic Production of Hot Atomic Hydrogen in RF Hydrogen/Helium Generated Plasmas", IEEE Transactions Plasma Science, submitted.**

A study of the line shapes of hydrogen Balmer series lines in RF generated low pressure H₂/He plasmas performed at the University of New Mexico, Department of Chemical and Nuclear Engineering produced results suggesting a catalytic process between helium and hydrogen species results in the generation of 'hot' (ca. 28 eV) atomic hydrogen. Even far from the electrodes (ca. 15 cm) both 'cold' (<2.5 eV) and 'hot' atomic hydrogen were found in H₂/He plasmas. Line shapes, relative line areas of cold and hot atomic hydrogen (hot/cold>2.5), were very similar for areas between the electrodes and far from the electrodes for these plasmas. In contrast, in H₂/Xe only 'warm' (<5 eV) hydrogen (warm/cold<1.0) was found between the electrodes, and only cold hydrogen away from the electrodes. Earlier postulates that preferential hydrogen line broadening in plasmas results from the acceleration of ionic hydrogen in the vicinity of electrodes, and the special charge exchange characteristics of Ar/H₂⁺ are clearly

belied by the present results that show atomic hydrogen line shape are similar for H_2/He plasmas throughout the relatively large cylindrical (14 cm ID x 36 cm length) cavity.

47. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, Luca Gamberale, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source", Central European Journal of Physics, submitted.

Luca Gamberale of the Advanced Research - Pirelli Labs, Milan, Italy performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of a chemically generated hydrogen plasma, extraordinarily broadened atomic hydrogen lines, lower-energy hydrogen molecular-ion lines, the isolation and characterization of lower-energy molecular hydrogen gas, and excess power measured by water bath calorimetry were replicated. Specifically, plasmas of certain catalysts such as Sr^+, Ar^+, and He^+ mixed with hydrogen were studied for evidence of a novel energetic reaction. A hydrogen plasma was observed to form at low temperatures (e.g. $\approx 10^3$ K) and an extraordinary low field strength of about 1-2 V/cm when argon and strontium were present with atomic hydrogen. RF and microwave plasmas were used to generate He^+ and Ar^+ catalysts. Extraordinarily fast H (40-50 eV) was observed by Balmer α line broadening only from plasmas having a catalyst with H. Novel emission lines with energies of $q \cdot 13.6\ eV$ where $q = 1,2,3,4,6,7,8,9,$ or 11 were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p}\ ;\ (p \leq 137\ \text{is an integer)}\ \text{replaces the well known parameter}\ n = \text{integer in}$$

the Rydberg equation for hydrogen excited states. $H(1/p)$ may react with a proton and two $H(1/p)$ may react to form $H_2(1/p)^+$ and $H_2(1/p)$, respectively, that have vibrational and rotational energies that are p^2 times those of the species comprising uncatalyzed atomic hydrogen. A series of over twenty peaks in the 10-65 nm region emitted from low-pressure helium-hydrogen (90/10%) and argon-hydrogen (90/10%) microwave

plasmas matched the energy spacing of 2^2 times the transition-state vibrational energy of H_2^+ with the series ending on the bond energy of $H_2(1/4)^+$. $H_2(1/p)$ gas was isolated by liquefaction using an high-vacuum (10^{-6} Torr) capable, liquid nitrogen cryotrap and was characterized by gas chromatography (GC), mass spectroscopy (MS), visible and EUV optical emission spectroscopy (OES), and ^1H NMR of the condensable gas dissolved in $CDCl_3$. Novel peaks were observed by cryogenic gas chromatography performed on the condensable gas which was highly pure hydrogen by MS and had a higher ionization energy than H_2. The observation that the EUV emission spectrum changed with deuterium substitution in a region where no hydrogen emission has ever been observed further supported the existence of lower-energy molecular hydrogen. Contaminants and exotic helium-hydrogen species were eliminated as the source of the reaction and condensed gas plasma emission spectra. Upfield shifted NMR peaks were observed at 3.47 ppm and 2.18 ppm compared to that of H_2 at 4.63 ppm that matched $H_2(1/2)$ and $H_2(1/4)$, respectively. Excess power was absolutely measured from the helium-hydrogen plasma. For an input of 44.3 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 62.9 W corresponding to 18.6 W of excess power in 3 cm^3. The excess power density and energy balance were high, $6.2\ W/cm^3$ and $-5 \times 10^4\ kJ/mole\ H_2$ ($240\ eV/H\ atom$), respectively.

46. **R. L. Mills, Y. Lu, J. He, M. Nansteel, P. Ray, X. Chen, A. Voigt, B. Dhandapani, "Spectral Identification of New States of Hydrogen", New Journal of Chemistry, submitted.**

Novel emission lines with energies of $q \cdot 13.6\ eV$ where $q = 1,2,3,4,6,7,8,9,11$ were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein $n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p}$; ($p \leq 137$ is an integer) replaces the well known parameter n = integer in the Rydberg equation for hydrogen excited states. Evidence supports that these states are formed by a resonant nonradiative energy

transfer to He^+ acting as a catalyst. Ar^+ also serves as a catalyst to form $H(1/p)$; whereas, krypton, xenon, and their ions serve as controls. $H(1/p)$ may react with a proton and two $H(1/p)$ may react to form $H_2(1/p)^+$ and $H_2(1/p)$, respectively, that have vibrational and rotational energies that are p^2 times those of the species comprising uncatalyzed atomic hydrogen. A series of over twenty peaks in the 10-65 nm region emitted from low-pressure helium-hydrogen (90/10%) and argon-hydrogen (90/10%) microwave plasmas matched the energy spacing of 2^2 times the transition-state vibrational energy of H_2^+ with the series ending on the bond energy of $H_2(1/4)^+$. Rotational lines were observed in the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)$. The results were independently recorded at <u>Rutgers University</u>. $H_2(1/p)$ gas was isolated by liquefaction at liquid nitrogen temperature and by decomposition of compounds found to contain the corresponding hydride ions $H^-(1/p)$. The $H_2(1/p)$ gas was dissolved in $CDCl_3$ and characterized by ^1H NMR at <u>Rider University, Lawrenceville NJ</u>. Considering solvent effects, singlet peaks upfield of H_2 were observed with a predicted integer spacing of 0.64 ppm at 3.47, 3.02, 2.18, 1.25, 0.85, and 0.22 ppm which matched the consecutive series $H_2(1/2)$, $H_2(1/3)$, $H_2(1/4)$, $H_2(1/5)$, $H_2(1/6)$, and $H_2(1/7)$, respectively. Excess power was absolutely measured from the helium-hydrogen plasma. For an input of 41.9 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 62.1 W corresponding to 20.2 W of excess power in 3 cm^3 plasma volume. The excess power density and energy balance were high, 6.7 W/cm^3 and $-5.4 \ X10^4 \ kJ/mole \ H_2$ ($280 \ eV/H \ atom$), respectively. In addition to power applications, battery and propellant reactions are proposed that may be transformational, and observed excited vibration-rotational levels of $H_2(1/4)$ could be the basis of a UV laser that could significantly advance photolithography.

45. **Dr. K.D. Keefer, Report on BlackLight Power Technology: Its Apparent Scientific Basis, State of Development and Stability for Commercialization by Liebert Corporation, (2001), and, Report on BlackLight Power Technology: Its Apparent Scientific Basis, State of Development and Stability for Commercialization, (2002).**

To separate reports disclosing the results of NMR, ToF-SIMS, XPS identification of novel hydrino hydride compounds and analysis of chemically-produced plasma by an expert hired by the Liebert Corporation, a division of the well-known and highly-respected Emerson Corporation. According to the expert's own words, he "observed demonstrations of the BlackLight Power (BLP) process and ...reached the inescapable conclusion that it is based on extraordinary chemical reactions that seem to release extraordinary amounts of energy.... It is [his] professional opinion that the BLP process represents a chemical conversion of atomic hydrogen unlike any previously reported [in] the archival scientific literature." Although the expert states that he was skeptical of Applicant's theory, he admitted that the chemical and plasma data did support Applicant's fractional quantum states and that he could offer no other explanation of the data using conventional quantum theory.

44. **A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002, http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf.**

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel performed verification studies as visiting researchers at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of extraordinarily broadened atomic hydrogen lines, population inversion, lower-energy hydrogen lines, and excess power measured by water bath calorimetry were replicated. The application of the energetic hydrogen to propulsion was studied.

Specifically, the data supporting hydrinos was replicated. See

i.) BlackLight Process Theory (pp. 10-12) which gives the theoretical energy levels for hydrinos and the catalytic reaction to form hydrinos,

ii.) Unique Hydrogen Line Broadening in Low Pressure Microwave Water

Plasmas (pp. 25-27, particularly Fig. 21) which shows that in the same microwave cavity

driven at the same power, the temperature of the hydrogen atoms in the microwave

plasma where the hydrino reaction was active was 50 times that of the control based on

the spectroscopic line widths,

iii.) Inversion of the Line Intensities in Hydrogen Balmer Series (pp. 27-28,

particularly Fig. 22) which shows for the first time in 40 years of intensive worldwide

research that atomic hydrogen population inversion was achieved in a steady state

plasma and supports the high power released from the reaction of hydrogen to form

hydrinos,

iv.) Novel Vacuum Ultraviolet (VUV) Vibration Spectra of Hydrogen Mixture

Plasmas (pp. 28-29, particularly Fig. 23) which shows a novel vibrational series of lines

in a helium-hydrogen plasmas at energies higher than any known vibrational series and

it identically matches the theoretical prediction of 2 squared times the corresponding

vibration of the ordinary hydrogen species, and

v.) Water Bath Calorimetry Experiments Showing Increased Heat Generation

(pp. 29-30, particularly Fig. 25) that shows that with exactly the same system and same

input power, the heating of the water reservoir absolutely measured to 1% accuracy

was equivalent to 55 to 62 W with the catalyst-hydrogen mixture compared to 40 W in

the control without the possibility of the reaction to form hydrinos.

43. **J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat
in 'Resonance Transfer' Plasmas", Journal of Applied Physics, Vol. 96, No. 6,
pp. 3095-3102.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National

Laboratory and University of New Mexico, performed verification studies as a visiting

researcher at BlackLight Power, Cranbury, NJ. Water bath calorimetry was used to

demonstrate one more peculiar phenomenon associated with a certain class of mixed

gas plasmas termed resonant transfer, or rt-plasmas. Specifically, He/H_2(10%) (500

mTorr), Ar/H_2(10%) (500 mTorr), and $H_2O(g)$ (500 mTorr and 200 mTorr) plasmas

generated with an Evenson microwave cavity consistently yielded on the order of 50% more heat than non rt-plasma (controls) such as He, Kr, Kr/H_2(10%), under identical conditions of gas flow, pressure, and microwave operating conditions. The excess power density of rt-plasmas was of the order $10\ W \cdot cm^{-3}$. In earlier studies with these same rt-plasmas it was demonstrated that other unusual features were present including dramatic broadening of the hydrogen Balmer series lines, unique vacuum ultraviolet (VUV) lines, and in the case of water plasmas, population inversion of the hydrogen excited states. Both the current results and the earlier results are completely consistent with the existence of a hitherto unknown exothermic chemical reaction, such as that predicted by Mills, occurring in rt-plasmas.

42. **R. L. Mills, P. C. Ray, R. M. Mayo, M. Nansteel, B. Dhandapani, J. Phillips, "Spectroscopic Study of Unique Line Broadening and Inversion in Low Pressure Microwave Generated Water Plasmas", J. Plasma Phys. Vol. 71, (2005), pp. 877-88.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. It was demonstrated that low pressure (~0.2 Torr) water vapor plasmas generated in a 10 mm ID quartz tube with an Evenson microwave cavity show at least two features which are not explained by conventional plasma models. First, significant (> 2.5 Å) hydrogen Balmer α line broadening was recorded, of constant width, up to 5 cm from the microwave coupler. Only hydrogen, and not oxygen, showed significant line broadening. This feature, observed previously in hydrogen-containing mixed gas plasmas generated with high voltage DC and RF discharges was explained by some researchers to result from acceleration of hydrogen ions near the cathode. This explanation cannot apply to the line broadening observed in the (electrodeless) microwave plasmas generated in this work, particularly at distances as great as 5 cm from the microwave coupler. Second, dramatic inversion of the line intensities of both the Lyman and Balmer series, again, at distances up to 5 cm from the coupler were observed. The dramatic line inversion suggests the existence of a hitherto unknown source of pumping of the optical power in plasmas. Finally, it is

notable that other aspects of the plasma including the OH^* rotational temperature and low electron concentrations are quite typical of plasmas of this type.

41. **H. Conrads, R. Mills, Th. Wrubel, "Emission in the Deep Vacuum Ultraviolet from a Plasma Formed by Incandescently Heating Hydrogen Gas with Trace Amounts of Potassium Carbonate", Plasma Sources Science and Technology, Vol. 12, (2003), pp. 389-395.**

The generation of a hydrogen plasma with intense extreme ultraviolet and visible emission was observed at Ruhr University, Bochum, Germany from low pressure hydrogen gas (0.1-1 mbar) in contact with a hot tungsten filament only when the filament heated a titanium dissociator coated with K_2CO_3 above 750°C. The dissociator was electrically floated, and the electric field strength from the filament was about 1 V/cm, two orders of magnitude lower than the starting voltages measured for gas glow discharges. The emission of the H_α and H_β transitions as well as the L_α and L_β transitions were recorded and analyzed. The plasma seemed to be far from thermal equilibrium, and no conventional mechanism was found to explain the formation of a hydrogen plasma by incandescently heating hydrogen gas with the presence of trace amounts of K_2CO_3. The temporal behavior of the plasma was recorded via hydrogen Balmer alpha line emission when all power into the cell was terminated. A two second decay of the plasma was observed after a fast decay of the electric field to zero. The plasma was found to be dependent on the chemistry of atomic hydrogen with potassium since no plasma formed with Na_2CO_3 replacing K_2CO_3 and the time constant of the emission following the removal of all of the power to the cell matched that of the cooling of the filament and the resulting shift from atomic to molecular hydrogen. Our results indicate that a novel chemical power source is present that forms the energetic hydrogen plasma. The plasma is a potential new light source.

40. **R. Mills, "Observation of Extreme Ultraviolet Emission from Hydrogen-KI Plasmas Produced by a Hollow Cathode Discharge", Int. J. Hydrogen Energy, Vol. 26, No. 6, (2001), pp. 579-592.**

A high voltage discharge of hydrogen with and without the presence of a source of potassium, potassium iodide, in the discharge was performed at Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany) with a hollow cathode. It has been reported that intense extreme ultraviolet (EUV) emission was observed at low temperatures (e.g. $< 10^3$ K) from atomic hydrogen and certain atomized elements or certain gaseous ions which ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV [1, 3-5]. Two potassium ions or a potassium atom may each provide an electron ionization or transfer reaction that has a net enthalpy equal to an integer multiple of 27.2 eV. The spectral lines of atomic hydrogen were intense enough to be recorded on photographic films only when KI was present. EUV lines not assignable to potassium, iodine, or hydrogen were observed at 73.0, 132.6, 513.6, 677.8, 885.9, and 1032.9 Å. The lines are assigned to transitions of atomic hydrogen to lower energy levels corresponding to lower energy hydrogen atoms called hydrino atoms and the emission from the excitation of the corresponding hydride ions formed from the hydrino atoms.

39. **R. Mills, "Temporal Behavior of Light-Emission in the Visible Spectral Range from a Ti-K$_2$CO$_3$-H-Cell", Int. J. Hydrogen Energy, Vol. 26, No. 4, (2001), pp. 327-332.**

Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany) reports the generation of a hydrogen plasma and extreme ultraviolet emission as recorded via the hydrogen Balmer emission in the visible range. Typically a hydrogen plasma is generated and the emission of extreme ultraviolet light from hydrogen gas is achieved via a discharge at high voltage, a high power inductively coupled plasma, or a plasma created and heated to extreme temperatures by RF coupling (e.g. $> 10^6$ K) with confinement provided by a toroidal magnetic field. The observed plasma formed at low temperatures (e.g. $\approx 10^3$ K) from atomic hydrogen generated at a tungsten filament that heated a titanium dissociator coated with potassium carbonate. The temporal behavior of the plasma was recorded via hydrogen Balmer alpha line emission when all power into the cell was terminated. A two second decay of the plasma was observed after a

fast decay of the electric field to zero. The persistence of emission following the removal of all of the power to the cell indicates that a novel chemical power source is present that forms an energetic plasma in hydrogen. No unusual behavior was observed with the control sodium carbonate.

38. **R. Mills, J. Sankar, A. Voigt, J. He, P. Ray, B. Dhandapani, "Synthesis and Characterization of Diamond Films from MPCVD of an Energetic Argon-Hydrogen Plasma and Methane", Materials Science, submitted.**

Polycrystalline diamond films were synthesized on silicon substrates by a low power (~80 W) microwave plasma chemical vapor deposition (MPCVD) reaction of a mixture of argon-hydrogen-methane (17.5/80/2.5%). The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that Ar^+ served as a catalyst with atomic hydrogen to form an energetic plasma. CH, C_2, and C_3 emissions were observed with significantly broadened H α line. The average hydrogen atom temperature of a argon-hydrogen-methane plasma was measured to be $110\text{-}130\ eV$ versus $\approx 3\ eV$ for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the CO tie line is eliminated along with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

37. **R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", European Physics Journal: Applied Physics, Vol. 28, (2004), pp. 83-104.**

$2K^+$ to $K + K^{2+}$ and K to K^{3+} provide a reaction with a net enthalpy equal to the one and three times the potential energy of atomic hydrogen, respectively. The presence of these gaseous ions or atoms with thermally dissociated hydrogen formed a so-called resonance transfer (rt) plasma having strong VUV emission with a stationary inverted Lyman population. Significant line broadening of the Balmer α, β, and γ lines of 18 eV was observed, compared to 3 eV from a hydrogen microwave plasma. Emission from rt-plasmas occurred even when the electric field applied to the plasma was zero as recorded at Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany. The reaction was exothermic since excess power of 20 $mW \cdot cm^{-3}$ was measured by Calvet calorimetry. An energetic catalytic reaction was proposed involving a resonant energy transfer between hydrogen atoms and $2K^+$ or K to form very stable novel hydride ions $H^-(1/p)$ called hydrino hydrides having a fractional principal quantum numbers $p = 2$ and $p = 4$, respectively. Characteristic emission was observed from K^{2+} and K^{3+} that confirmed the resonant nonradiative energy transfer of $27.2\ eV$ and $3 \cdot 27.2\ eV$ from atomic hydrogen to $2K^+$ and K, respectively.

The predicted binding energy of $H^-(1/2)$ of $3.0471\ eV$ with the fine structure was observed at 4071 Å, and its predicted bound-free hyperfine structure lines $E_{HF} = j^2 3.00213 \ X \ 10^{-5} + 3.0563\ eV$ (j is an integer) matched those observed for $j = 1$ to $j = 37$ to within a 1 part per 10^4. $H^-(1/4)$ was observed spectroscopically at 110 nm corresponding to its predicted binding energy of $11.2\ eV$. The ^1H MAS NMR spectrum (Spectral Data Services, Inc., Champaign, IL) of novel compound $KH * Cl$ relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of p = 4. A novel NMR (Grace Davison, Columbia, MD and Spectral Data Services, Inc., Champaign, IL) peak of $KH * I$ at -1.5 ppm relative to TMS corresponding to an absolute resonance shift of -33.0 ppm matched the theoretical prediction of p = 2. The predicted catalyst reactions, position of the upfield-shifted NMR peaks, and spectroscopic data for $H^-(1/2)$ and $H^-(1/4)$ were found to be in agreement.

36. **R. L. Mills, P. Ray, B. Dhandapani, J. He, "Novel Liquid-Nitrogen-Condensable Molecular Hydrogen Gas", Acta Physica Polonica A, submitted.**

Extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel emission lines were observed with energies of $q \cdot 13.6 \, eV$ where $q = 1,2,3,4,6,7,8,9,11$ or these discrete energies less $21.2 \, eV$ corresponding to inelastic scattering of these photons by helium atoms due to excitation of $He \, (1s^2)$ to $He \, (1s^1 2p^1)$. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen, formed by a resonant nonradiative energy transfer to He^+. Corresponding emission due to the reaction $2H(1/2) \rightarrow H_2(1/2)$ with vibronic coupling at

$$E_{D+vib} = p^2 E_{D \, H_2} \pm \left(\frac{v*}{3} \right) E_{vib \, H_2(v=0 \rightarrow v=1)}, \quad v* = 1,2,3... \text{ was observed at the longer}$$

wavelengths for $v* = 2$ to $v* = 32$ and at the shorter wavelengths for $v* = 1$ to $v* = 16$ where $E_{D \, H_2}$ and $E_{vib \, H_2(v=0 \rightarrow v=1)}$ are the experimental bond and vibrational energies of H_2, respectively. Fractional-principal-quantum-level molecular hydrogen $H_2(1/p)$ gas was isolated by liquefaction using an ultrahigh-vacuum, liquid nitrogen cryotrap and was characterized by gas chromatography (GC), mass spectroscopy (MS), optical emission spectroscopy (OES), and ^1H NMR (Rider University, Lawrenceville NJ) of the condensable gas dissolved in $CDCl_3$. The condensable gas was highly pure hydrogen by GC and MS and had a higher ionization energy than H_2. An upfield shifted NMR peaks were observed at 3.47 and 2.18 ppm compared to that of H_2 at 4.63 ppm. A theoretical rocketry propellant reaction is given that may be transformational.

35. **R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Spectroscopic Characterization of the Atomic Hydrogen Energies and Densities and Carbon Species During Helium-Hydrogen-Methane Plasma CVD Synthesis of Single Crystal Diamond Films", Chemistry of Materials, Vol. 15, (2003), pp. 1313-1321.**

Polycrystalline diamond films were synthesized on silicon substrates for the first time without diamond seeding by a very low power (38 W) microwave plasma continuous vapor deposition (MPCVD) reaction of a mixture of helium-hydrogen-

methane (48.2/48.2/3.6%). The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA and Jobin Yvon Inc., Edison, NJ), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada and Material Testing Laboratory, Pennington, NJ), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that He^+ served as a catalyst with atomic hydrogen to form an energetic plasma. CH, C_2, and C_3 emissions were observed with significantly broadened H α, β, γ, and δ lines. The average hydrogen atom temperature of a helium-hydrogen-methane plasma was measured to be $120 - 140 \, eV$ versus $\approx 3 \, eV$ for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the CO tie line is eliminated along with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

34. **R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Low Power MPCVD of Diamond Films on Silicon Substrates", Journal of Vacuum Science & Technology A, submitted.**

Polycrystalline diamond films were synthesized on silicon substrates for the first time without diamond seeding by a very low power (38 W) microwave plasma continuous vapor deposition (MPCVD) reaction of a mixture of 10-30% hydrogen, 90-70% helium, and 1-10% CH_4. The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada and Material Testing Laboratory, Pennington, NJ), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that He^+ served as a catalyst with atomic

hydrogen to form an energetic plasma. The average hydrogen atom temperature was measured to be $180 - 210 \, eV$ versus $\approx 3 \, eV$ for pure hydrogen. The electron temperature T_e for helium-hydrogen was 28,000 K compared to 6800 K for pure helium. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the CO tie line is eliminated along with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

33. **R. L. Mills, A. Voigt, B. Dhandapani, J. He, "Synthesis and Spectroscopic Identification of Lithium Chloro Hydride", Materials Characterization, submitted.**

A novel inorganic hydride compound, lithium chloro hydride ($LiHCl$), which comprises a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and lithium chloride. Lithium chloro hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), ^1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and powder X-ray diffraction (IC Laboratories, Amawalk, NY). Hydride ions with increased binding energies may form many novel compounds with broad applications such as the oxidant of a high voltage battery.

32. **R. L. Mills, B. Dhandapani, J. He, "Highly Stable Amorphous Silicon Hydride", Solar Energy Materials & Solar Cells, Vol. 80, No. 1, (2003), pp. 1-20.**

A novel highly stable hydrogen terminated silicon coating was synthesized by microwave plasma reaction of mixture of silane, hydrogen, and helium wherein it is proposed that He^+ served as a catalyst with atomic hydrogen to form highly stable silicon hydrides. Novel silicon hydride was identified by time of flight secondary ion mass spectroscopy and X-ray photoelectron spectroscopy. The time of flight secondary ion mass spectroscopy (ToF-SIMS) identified the coatings as hydride by the large SiH^+

peak in the positive spectrum and the dominant H^- in the negative spectrum. Since hydrogen is the only element with no primary element peaks, X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) identified the H content of the SiH coatings as comprising novel silicon hydrides due to new peaks at 11, 43, and 55 eV in the absence of corresponding peaks of any candidate element at higher binding energies. The silicon hydride surface was remarkably stable to air as shown by XPS. The highly stable amorphous silicon hydride coating may advance the production of integrated circuits and microdevices by resisting the oxygen passivation of the surface and possibly altering the dielectric constant and band gap to increase device performance.

31. **R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Synthesis of HDLC Films from Solid Carbon", J. of Material Science, Vol. 39 (2004), pp. 3309-18.**

Diamond-like carbon (DLC) films were synthesized on silicon substrates from solid carbon by a very low power (~60 W) microwave plasma chemical vapor deposition (MPCVD) reaction of a mixture of 90-70% helium and 10-30% hydrogen. It is proposed that He^+ served as a catalyst with atomic hydrogen to form an energetic plasma. The average hydrogen atom temperature of a helium-hydrogen plasma was measured to be $180 - 210 \, eV$ versus $\approx 3 \, eV$ for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of DLC. The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), and Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA). TOF-SIMS identified the coatings as hydride by the large H^+ peak in the positive spectrum and the dominant H^- in the negative spectrum. The XPS identification of the H content of the CH coatings as a novel hydride corresponding to a peak at 49 eV has implications that the mechanism of the DLC formation may also involve one or both of selective etching of graphitic carbon and the stabilization of sp^3-bonded carbon by the hydrogen catalysis

product. Thus, a novel H intermediate formed by the plasma catalysis reaction may enhance the stabilization and etching role of H used in past methods.

30. **R. L. Mills, J. He, P. Ray, B. Dhandapani, X. Chen, "Synthesis and Characterization of a Highly Stable Amorphous Silicon Hydride as the Product of a Catalytic Helium-Hydrogen Plasma Reaction", Int. J. Hydrogen Energy, in press.**

A novel highly stable surface coating $SiH(1/p)$ which comprised high binding energy hydride ions was synthesized by a microwave plasma reaction of a mixture of silane, hydrogen, and helium wherein it is proposed that He^+ served as a catalyst with atomic hydrogen to form the highly stable hydride ions. Novel silicon hydride was identified by time of flight secondary ion mass spectroscopy and X-ray photoelectron spectroscopy. The time of flight secondary ion mass spectroscopy (ToF-SIMS) identified the coatings as hydride by the large SiH^+ peak in the positive spectrum and the dominant H^- in the negative spectrum. X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) identified the H content of the SiH coatings as hydride ions, $H^-(1/4)$, $H^-(1/9)$, and $H^-(1/11)$ corresponding to peaks at 11, 43, and 55 eV, respectively. The silicon hydride surface was remarkably stable to air as shown by XPS. The highly stable amorphous silicon hydride coating may advance the production of integrated circuits and microdevices by resisting the oxygen passivation of the surface and possibly altering the dielectric constant and band gap to increase device performance.

The plasma which formed $SiH(1/p)$ showed a number of extraordinary features. Novel emission lines with energies of $q \cdot 13.6 \, eV$ where $q = 1,2,3,4,6,7,8,9,$ *or* 11 were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, Vol. 27, No. 3, pp. 301-322]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen where p is an integer, formed by a resonant nonradiative energy transfer to

He^+ acting as a catalyst. The average hydrogen atom temperature of the helium-hydrogen plasma was measured to be $180\text{-}210\,eV$ versus $\approx 3\,eV$ for pure hydrogen. Using water bath calorimetry, excess power was observed from the helium-hydrogen plasma compared to control krypton plasma. For example, for an input of 8.1 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 30.0 W corresponding to 21.9 W of excess power in $3\,cm^3$. The excess power density and energy balance were high, $7.3\,W/cm^3$ and $-2.9\,X\,10^4\,kJ/mole\,H_2$, respectively. This catalytic plasma reaction may represent a new hydrogen energy source and a new field of hydrogen chemistry.

29. **R. L. Mills, A. Voigt, B. Dhandapani, J. He, "Synthesis and Characterization of Lithium Chloro Hydride", Int. J. Hydrogen Energy, submitted.**

A novel inorganic hydride compound lithium chloro hydride, $LiHCl$, which comprises a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and lithium chloride. Lithium chloro hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), ^1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and powder X-ray diffraction (IC Laboratories, Amawalk, NY). Hydride ions with increased binding energies may form many novel compounds with broad applications such as the oxidant of a high voltage battery.

28. **R. Mills, E. Dayalan, P. Ray, B. Dhandapani, J. He, "Highly Stable Novel Inorganic Hydrides from Aqueous Electrolysis and Plasma Electrolysis", Electrochimica Acta, Vol. 47, No. 24, (2002), pp. 3909-3926.**

After 10^4 hours of continuous aqueous electrolysis with K_2CO_3 as the electrolyte, highly stable novel inorganic hydride compounds such as $KHKHCO_3$ and KH were isolated and identified by time of flight secondary ion mass spectroscopy (ToF-SIMS) (Charles Evans East, East Windsor, NJ). The existence of novel hydride ions was determined using X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for

Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) and solid state magic-angle spinning ^1H nuclear magnetic resonance spectroscopy (^1H MAS NMR) (Spectral Data Services, Inc., Champaign, IL). A novel ion formed by plasma electrolysis of a K_2CO_3, Rb_2CO_3, or Cs_2CO_3 electrolyte was also observed by high resolution visible spectroscopy at 407.0 nm corresponding to its predicted binding energy of $3.05\ eV$.

27. **R. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", Int. J. Hydrogen Energy, Vol. 26, No. 9, Sept. (2001), pp. 965-979.**

Novel inorganic alkali and alkaline earth hydrides of the formula $MH*$, MH_2^*, and $MH*X$ wherein M is the metal, X, is a halide, and $H*$ comprises a novel high binding energy hydride ion were synthesized in a high temperature gas cell by reaction of atomic hydrogen with a catalyst and MH, MH_2, or MX corresponding to an alkali metal or alkaline earth metal compound, respectively. Novel hydride ions of the corresponding novel hydride compounds were characterized by an extraordinary upfield shifted peak observed by ^1H nuclear magnetic resonance spectroscopy. The result were confirmed on five different instruments at five independent laboratories (Spectral Data Services, Inc., Champaign, IL, National Research Council of Canada, University of Massachusetts Amherst, Amherst, MA, University of Delaware, Wilmington, DE, and Grace Davison, Columbia, MD).

26. **R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.**

A novel inorganic hydride compound KHI which comprises a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and potassium iodide. Potassium iodo hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer

Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), ^1H and ^{39}K nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), Fourier transform infrared spectroscopy (Surface Science Laboratories, Mountain View, CA), electrospray ionization time of flight mass spectroscopy (Perkin-Elmer Biosystems, Framingham, MA), liquid chromatography/mass spectroscopy (Ricerca, Inc., Painesville, Ohio), thermal decomposition with analysis by gas chromatography, and mass spectroscopy, and elemental analysis (Galbraith Laboratories, Inc., Knoxville, TN). Hydride ions with increased binding energies may form many novel compounds with broad applications.

25. **R. Mills, "Novel Inorganic Hydride", Int. J. of Hydrogen Energy, Vol. 25, (2000), pp. 669-683.**

A novel inorganic hydride compound $KH\,KHCO_3$ which is stable in water and comprises a high binding energy hydride ion was isolated following the electrolysis of a K_2CO_3 electrolyte. Inorganic hydride clusters $K[KH\,KHCO_3]_n^+$ were identified by Time of Flight Secondary Ion Mass Spectroscopy (Charles Evans East, East Windsor, NJ). Moreover, the existence of a novel hydride ion has been determined using X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), and ^1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL). Hydride ions with increased binding energies may be the basis of a high voltage battery for electric vehicles.

24. **R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", Int. J. of Hydrogen Energy, Vol. 26, No. 4, (2001), pp. 339-367.**

Novel inorganic alkali and alkaline earth hydrides of the formula MHX and $MHMX$ wherein M is the metal, X, is a singly negatively charged anion, and H comprises a novel high binding energy hydride ion were synthesized in a high temperature gas cell by reaction of atomic hydrogen with a catalyst and MX or MX_2

corresponding to an alkali metal or alkaline earth metal, respectively. It has been reported that intense extreme ultraviolet (EUV) emission was observed at low temperatures (e.g. $\approx 10^3 \ K$) from atomic hydrogen and certain atomized elements or certain gaseous ions which ionize at integer multiples of the potential energy of atomic hydrogen, $27.2 \ eV$ [1-5]. These atomized elements or certain gaseous ions comprised the catalyst to form MHX and $MHMX$. For example, atomic hydrogen was reacted with strontium vapor and $SrBr_2$ to form $SrHBr$. Novel hydride compounds such as $SrHBr$ were identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), ^1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and thermal decomposition with analysis by gas chromatography, and mass spectroscopy. Hydride ions with increased binding energies form novel compounds with potential broad applications such as a high voltage battery for consumer electronics and electric vehicles. In addition, these novel compositions of matter and associated technologies may have far-reaching applications in many industries including chemical, electronics, computer, military, energy, and aerospace in the form of products such as propellants, solid fuels, surface coatings, structural materials, and chemical processes.

23. R. Mills, "Highly Stable Novel Inorganic Hydrides", Journal of New Materials for Electrochemical Systems, Vol. 6, (2003), pp. 45-54.

Novel inorganic hydride compounds $KHKHCO_3$ and KH were isolated following the electrolysis of a K_2CO_3 electrolyte. The compounds which comprised high binding energy hydride ions were stable in water, and KH was stable at elevated temperature (600 °C). Inorganic hydride clusters $K[KHKHCO_3]_n^+$ were identified by positive Time of Flight Secondary Ion Mass Spectroscopy (ToF-SIMS) of $KHKHCO_3$ (Charles Evans East, East Windsor, NJ). The negative ToF-SIMS was dominated by hydride ion. The positive and negative ToF-SIMS of KH showed essentially K^+ and H^- only, respectively. Moreover, the existence of novel hydride ions was determined using X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair

Laboratory, Lehigh University, Bethlehem, PA), and ^1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL). Hydride ions with increased binding energies may be the basis of a high voltage battery for electric vehicles.

22. **R. Mills, "Novel Hydrogen Compounds from a Potassium Carbonate Electrolytic Cell", Fusion Technology, Vol. 37, No. 2, March, (2000), pp. 157-182.**

Novel compounds containing hydrogen in new hydride and polymeric states which demonstrate novel hydrogen chemistry have been isolated following the electrolysis of a K_2CO_3 electrolyte with the production of excess energy. Inorganic hydride clusters $K[KH\,KHCO_3]_n^+$ and hydrogen polymer ions such as OH_{23}^+ and H_{16}^- were identified by time of flight secondary ion mass spectroscopy (Charles Evans East, East Windsor, NJ). The presence of compounds containing new states of hydrogen were confirmed by X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), X-ray diffraction, Fourier transform infrared spectroscopy (Surface Science Laboratories, Mountain View, CA), Raman spectroscopy (Environmental Catalysis and Materials Laboratory of Virginia Polytechnic Institute), and ^1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL).

21. **Mills, R., Good, W., "Fractional Quantum Energy Levels of Hydrogen", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1697-1719.**

Determination of excess heat release during the electrolysis of aqueous potassium carbonate by the very accurate and reliable method of heat measurement, flow calorimetry; describes the experimental identification of hydrogen atoms in fractional quantum energy levels—hydrinos—by X-ray Photoelectron Spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA); describes the experimental identification of hydrogen atoms in fractional quantum energy levels—hydrinos—by emissions of soft X-rays from dark

matter; describes the experimental identification of hydrogen molecules in fractional quantum energy levels—dihydrino molecules by high resolution magnetic sector mass spectroscopy with ionization energy determination, and gives a summary.

In summary:

Excess power and heat were observed during the electrolysis of aqueous potassium carbonate. Flow calorimetry of pulsed current electrolysis of aqueous potassium carbonate at a nickel cathode was performed in a single-cell dewar. The average power out of 24.6 watts exceeded the average input power (voltage times current) of 4.73 watts by a factor greater than 5. The total input energy (integration of voltage times current) over the entire duration of the experiment was 5.72 MJ; whereas, the total output energy was 29.8 MJ. No excess heat was observed when the electrolyte was changed from potassium carbonate to sodium carbonate. The source of heat is assigned to the electrocatalytic, exothermic reaction whereby the electrons of hydrogen atoms are induced to undergo transitions to quantized energy levels below the conventional "ground state". These lower energy states correspond to fractional quantum numbers: n = 1/2, 1/3, 1/4, ... Transitions to these lower energy states are stimulated in the presence of pairs of potassium ions (K^+/K^+ electrocatalytic couple) which provide 27.2 eV energy sinks.

The identification of the n = 1/2 hydrogen atom , H(n = 1/2) is reported. Samples of the nickel cathodes of aqueous potassium carbonate electrolytic cells and aqueous sodium carbonate electrolytic cells were analyzed by XPS (<u>Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA</u>). A broad peak centered at 54.6 eV was present only in the cases of the potassium carbonate cells. The binding energy (in vacuum) of H(n = 1/2) is 54.4 eV. Thus, the theoretical and measured binding energies for H(n = 1/2) are in excellent agreement.

Further experimental identification of hydrinos—down to H(n = 1/8)—can be found in the alternative explanation by Mills et al. for the soft X-ray emissions of the dark interstellar medium observed by Labov and Bowyer [Labov, S., Bowyer, S., "Spectral observations of the extreme ultraviolet background", The Astrophysical Journal, 371, (1991), pp. 810-819] of the Extreme UV Center of the University of California, Berkeley.

The agreement between the experimental spectrum and the energy values predicted for the proposed transitions is remarkable.

The reaction product of two H(n=1/2) atoms, the dihydrino molecule, was identified by mass spectroscopy (Shrader Analytical & Consulting Laboratories). The mass spectrum of the cryofiltered gases evolved during the electrolysis of a light water K_2CO_3 electrolyte with a nickel cathode demonstrated that the dihydrino molecule,

$H_2\left(n=\frac{1}{2}\right)$, has a higher ionization energy, about 63 eV, than normal molecular

hydrogen, $H_2(n=1)$, 15.46 eV. The high resolution (0.001 AMU) magnetic sector mass spectroscopic analysis of the postcombustion gases indicated the presence of two peaks of nominal mass two-- one peak at 70 eV and one peak at 25 eV. The same analysis of molecular hydrogen indicates only one peak at 25 eV and one peak at 70 eV. In the case of the postcombustion sample at 70 eV, one peak was assigned as the hydrogen molecular ion peak, $H_2^+(n=1)$, and one peak was assigned as the dihydrino

molecular peak, $H_2^+\left(n=\frac{1}{2}\right)$ which has a slightly larger magnetic moment.

20. **Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994).**

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed by Thermacore, Inc., Lancaster, PA. The excess power out of 41 watts exceeded the total input power given by the product of the electrolysis voltage and current by a factor greater than 8. Elemental analysis of the electrolyte and metallurgical analysis of the cathode showed no evidence of chemical reactions. The pH, specific gravity, concentration of K_2CO_3, and the elemental analysis of the electrolyte sample taken after 42 days of continuous operation were unchanged from that of the values obtained for the electrolyte sample taken before operation. Elemental analysis and scanning electron microscopy of metallurgical samples of the nickel cathode taken before operation and at day 56 of continuous operation were identical indicating that the nickel cathode had not changed chemically or physically. Scintillation counter and

photographic film measurements showed that no radiation above background was detected indicating that nuclear reactions did not occur.

The "ash" of the exothermic reaction is atoms having electrons of energy below the "ground state" which are predicted to form molecules. The predicted molecules were identified by lack of reactivity with oxygen, by separation from molecular deuterium by cryofiltration, and by mass spectroscopic analysis. The combustion of the gases evolved during the electrolysis of a light water K_2CO_3 electrolyte (K^+/K^+ electrocatalytic couple) with a nickel cathode was incomplete. The mass spectroscopic analysis (Dr. David Parees of Air Products & Chemicals, Inc.) of the m/e = 2 peak of the combusted gas demonstrated that the dihydrino molecule, $H_2(n = 1/2)$, has a higher ionization energy than H_2.

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cells by HydroCatalysis Power Corporation. Excess power out exceeded input power by a factor greater than 16. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate. The faraday efficiency was measured volumetrically to be 100%.

19. V. Noninski, Fusion Technol., Vol. 21, 163 (1992).

Dr. Noninski of the <u>Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER)</u> successfully reproduced the results of Mills and Kneizys [R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991)] as a visiting professor at <u>Franklin and Marshall College</u>. A significant increase in temperature with every watt input, compared with the calibration experiment ($\approx 50 \, ^\circ C \, / \, W$ versus $\approx 30 \, ^\circ C \, / \, W$), was observed during the electrolysis of potassium carbonate. This effect was not observed when sodium carbonate was electrolyzed. No trivial explanation (in terms of chemical reactions, change in heat transfer properties, etc.) of this effect were found.

18. Niedra, J., Meyers, I., Fralick, G. C., and Baldwin, R., "Replication of the Apparent Excess Heat Effect in a Light Water-Potassium Carbonate-Nickel

Electrolytic Cell, NASA Technical Memorandum 107167, February, (1996). pp. 1-20.; Niedra, J., Baldwin, R., Meyers, I., NASA Presentation of Light Water Electrolytic Tests, May 15, 1994.

NASA Lewis tested a cell identical to that of Thermacore [Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994)] with the exception that it was minus the central cathode. A cell identical to the test cell with heater power only (no electrolysis) was the calibration control and the blank cell with the heater power equal to zero. The test cell was also calibrated "on the fly" by measuring the temperature relative to the blank cell at several values of heater input power of the test cell. "Replication of experiments claiming to demonstrate excess heat production in light water-Ni- K_2CO_3 electrolytic cells was found to produce an apparent excess heat of 11 W maximum, for 60 W electrical power into the cell. Power gains ranged from 1.06 to 1.68." The production of excess energy with a power gain of 1.68 would require 0% Faraday efficiency to account for the observed excess power.

17. **Technology Insights, 6540 Lusk Boulevard, Suite C-102, San Diego, CA 92121, "HydroCatalysis Technical Assessment Prepared for PacifiCorp", August 2, 1996.**

This report documents a technical assessment of a novel source of hydrogen energy advanced by HydroCatalysis Power Corporation now BlackLight Power, Inc. (BLP). The assessment was conducted as part of the due diligence performed for PacifiCorp. It was conducted by a literature search and review, site visits to BLP and collaborating organizations, and telephone interviews with others active in the general area. A description of concept is provided in Section 3. Section 4 presents an assessment of the concept background, supporting theory, laboratory prototypes, projected initial products, and economic and environmental aspects. Section 5 documents the results of telephone interviews and site visits. An overall summary and conclusions are presented in the following section.

16. **P. M. Jansson, "HydroCatalysis: A New Energy Paradigm for the 21st Century", Thesis Submitted in partial fulfillment of the requirements of the**

Masters of Science in Engineering Degree in the Graduate Division of <u>Rowan University</u>, May 1997, Thesis Advisors: Dr. J. L. Schmalzel, Dr. T. R. Chandrupatla, and Dr. A. J. Marchese, External Advisors: Dr. J. Phillips, Pennsylvania State University, Dr. R. L. Mills, BlackLight Power, Inc., W. R. Good, BlackLight Power, Inc.

This thesis reviews the problems of worldwide energy supply, describes the current technologies that meet the energy needs of our industrial societies, summarizes the environmental impacts of those fuels and technologies and their increased use by a growing global and increasing technical economy. The work also describes and advances the technology being developed by BlackLight Power, Inc. (BLP) a scientific company located in Princeton, New Jersey. BLP's technology purports to offer commercially viable and useful heat generation via a previously unrecognized natural phenomenon - the catalytic reduction of the hydrogen atom to a lower energy state. Laboratory tests obtained as original research of this thesis as well as the review of the data of others substantiate the fact that replication of the experimental conditions which are favorable to initiating and sustaining the new energy release process will generate controllable, reproducible, sustainable and commercial meaningful heat. For example, Jansson has determined heat production associated with hydrino formation with a Calvet calorimeter which yielded exceptional results. Specifically, the results are completely consistent with Mills hydrino formation hypothesis. Approximately 10^{-3} moles of hydrogen was admitted to a 20 cm^3 Calvet cell containing a heated platinum filament and KNO_3 powder. In the three separate trials with a platinum filament hydrogen dissociator which was varied in length of 10 cm, 20 cm, and 30 cm, a mean power of 0.581, 0.818, and 1.572 watts was observed, respectively. The closed experiments were run to completion. The energy observed was 622, 369, and 747 kJ, respectively, This is equivalent to the generation of $6.2 \times 10^8 \, J/mole$, $3.7 \times 10^8 \, J/mole$, and $7.5 \times 10^8 \, J/mole$ of hydrogen, respectively, as compared to $2.5 \times 10^5 \, J/mole$ of hydrogen anticipated for standard hydrogen combustion. Thus, the total heats generated appear to be at least 1000 times too large to be explained by conventional chemistry, but the results are completely consistent with Mills model. Convincing

evidence is presented to lead to the conclusion that BLP technology has tremendous potential to achieve commercialization and become an energy paradigm for the next century. The research was also conducted as part of the due diligence performed for Atlantic Energy now Connectiv.

15. **Phillips, J., Smith, J., Kurtz, S., "Report On Calorimetric Investigations Of Gas-Phase Catalyzed Hydrino Formation" Final report for Period October-December 1996", January 1, 1997, A Confidential Report submitted to BlackLight Power, Inc. provided by BlackLight Power, Inc., Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined heat production associated with hydrino formation with a Calvet calorimeter which yielded exceptional results. Specifically, the results are completely consistent with Mills hydrino formation hypothesis. In three separate trials, between 10 and 20 K Joules were generated at a rate of 0.5 Watts, upon admission of approximately 10^{-3} moles of hydrogen to the 20 cm^3 Calvet cell containing a heated platinum filament and KNO_3 powder. This is equivalent to the generation of 10^7 $J/mole$ of hydrogen, as compared to 2.5×10^5 $J/mole$ of hydrogen anticipated for standard hydrogen combustion. Thus, the total heats generated appear to be 100 times too large to be explained by conventional chemistry, but the results are completely consistent with Mills model.

14. **Phillips, J., Shim, H., "Additional Calorimetric Examples of Anomalous Heat from Physical Mixtures of K/Carbon and Pd/Carbon", January 1, 1996, A Confidential Report submitted to HydroCatalysis Power Corporation provided by HydroCatalysis Power Corporation, Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined excess heat release from flowing hydrogen in the presence of ionic hydrogen spillover catalytic material: 40% by weight potassium nitrate (KNO_3) on graphitic carbon powder with 5% by weight 1%-Pd-on-graphitic carbon (K^+/K^+ electrocatalytic couple) by the very

accurate and reliable method of heat measurement, thermopile conversion of heat into an electrical output signal. Excess power and heat were observed with flowing hydrogen over the catalyst. However, no excess power was observed with flowing helium over the catalyst mixture. Rates of heat production were reproducibly observed which were higher than that expected from the conversion of all the hydrogen entering the cell to water, and the total energy observed was over four times larger than that expected if all the catalytic material in the cell were converted to the lowest energy state by "known" chemical reactions. Thus, "anomalous" heat, heat of a magnitude and duration which could not be explained by conventional chemistry, was reproducibly observed.

13. **Bradford, M. C., Phillips, J., "A Calorimetric Investigation of the Reaction of Hydrogen with Sample PSU #1", September 11, 1994, A Confidential Report submitted to HydroCatalysis Power Corporation provided by HydroCatalysis Power Corporation, Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined excess heat release from flowing hydrogen in the presence of nickel oxide powder containing strontium niobium oxide (Nb^{3+}/Sr^{2+} electrocatalytic couple) by the very accurate and reliable method of heat measurement, thermopile conversion of heat into an electrical output signal. Excess power and heat were observed with flowing hydrogen over the catalyst which increased with increasing flow rate. However, no excess power was observed with flowing helium over the catalyst/nickel oxide mixture or flowing hydrogen over nickel oxide alone. Approximately 10 cc of nickel oxide powder containing strontium niobium oxide immediately produced 0.55 W of steady state output power at 523 K. When the gas was switched from hydrogen to helium, the power immediately dropped. The switch back to hydrogen restored the excess power output which continued to increase until the hydrogen source cylinder emptied at about the 40,000 second time point. With no hydrogen flow the output power fell to zero.

The source of heat is assigned to the electrocatalytic, exothermic reaction whereby the electrons of hydrogen atoms are induced to undergo transitions to

quantized energy levels below the conventional "ground state". These lower energy states correspond to fractional quantum numbers: n = 1/2, 1/3, 1/4, ... Transitions to these lower energy states are stimulated in the presence of pairs of niobium and strontium ions (Nb^{3+}/Sr^{2+} electrocatalytic couple) which provide 27.2 eV energy sinks.

12. **Jacox, M. G., Watts, K. D., "The Search for Excess Heat in the Mills Electrolytic Cell", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, January 7, 1993.**

Idaho National Engineering Laboratory (INEL) operated a cell identical to that of Thermacore [Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994)] except that it was minus the central cathode and that the cell was wrapped in a one-inch layer of urethane foam insulation about the cylindrical surface. The cell was operated in a pulsed power mode. A current of 10 amperes was passed through the cell for 0.2 seconds followed by 0.8 seconds of zero current for the current cycle. The cell voltage was about 2.4 volts, for an average input power of 4.8 W. The electrolysis power average was 1.84 W, and the stirrer power was measured to be 0.3 W. Thus, the total average net input power was 2.14 W. The cell was operated at various resistance heater settings, and the temperature difference between the cell and the ambient as well as the heater power were measured. The results of the excess power as a function of cell temperature with the cell operating in the pulsed power mode at 1 Hz with a cell voltage of 2.4 volts, a peak current of 10 amperes, and a duty cycle of 20 % showed that the excess power is temperature dependent for pulsed power operation, and the maximum excess power was 18 W for an input electrolysis joule heating power of 2.14 W. Thus, the ratio of excess power to input electrolysis joule heating power was 850 %. INEL scientists constructed an electrolytic cell comprising a nickel cathode, a platinized titanium anode, and a 0.57 M K_2CO_3 electrolyte. The cell design appears in Appendix 1. The cell was operated in the environmental chamber in the INEL Battery Test Laboratory at constant current, and the heat was removed by forced air convection in two cases. In the first case, the air was circulated by the environmental chamber circulatory system alone. In the second case,

an additional forced air fan was directed onto the cell. The cell was equipped with a water condenser, and the water addition to the cell due to electrolysis losses was measured. The data of the forced convection heat loss calorimetry experiments during the electrolysis of a 0.57 M K_2CO_3 electrolyte with the INEL cell showed that 13 W of excess power was produced. This excess power could not be attributed to recombination of the hydrogen and oxygen as indicated by the equivalence of the calculated and measured water balance.

11. **Peterson, S., H., Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC, 1310 Beulah Road, Pittsburgh, PA, February 25, 1994.**

　　Westinghouse Electric Corporation reports that excess heat was observed during the electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) where the electrolysis of aqueous sodium carbonate served as the control. The data of the temperature of the cell minus the ambient temperature shows that when potassium carbonate replaced sodium carbonate in the same cell with the same input electrolysis power, the potassium experiment was twice as hot as the sodium carbonate experiment for the duration of the experiment, one month. The net faraday efficiency of gas evolution was experimentally measured to be unity by weighing the experiment to determine that the expected rate of water consumption was observed. The output power exceeded the total input power. The data was analyzed by HydroCatalysis Power Corporation [Mills, R., Analysis by HydroCatalysis Power Corporation of Westinghouse Report Entitled "Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC", February 25, 1994].

10. **Haldeman, C. W., Savoye, G. W., Iseler, G. W., Clark, H. R., MIT Lincoln Laboratories Excess Energy Cell Final report ACC Project 174 (3), April 25, 1995.**

During the electrolysis of aqueous potassium carbonate, researchers working at MIT Lincoln Laboratories observed long duration excess power of 1-5 watts with output/input ratios over 10 in some cases with respect to the cell input power reduced by the enthalpy of the generated gas. In these cases, the output was 1.5 to 4 times the integrated volt-ampere power input. Faraday efficiency was measured volumetrically by direct water displacement.

9. **Craw-Ivanco, M. T.; Tremblay, R. P.; Boniface, H. A.; Hilborn, J. W.; "Calorimetry for a Ni/ K_2CO_3 Cell", Atomic Energy Canada Limited, Chemical Engineering Branch, Chalk River Laboratories, Chalk River, Ontario, June 1994.**

Atomic Energy Canada Limited, Chalk River Laboratories, report that 128 % and 138% excess heat were observed in separate experiments by flow calorimetry during the electrolysis of aqueous potassium carbonate (K+/K+ electrocatalytic couple) in a closed cell, and that 138% was observed in an open cell.

8. **Shaubach, R. M., Gernert, N. J., "Anomalous Heat From Hydrogen in Contact with Potassium Carbonate", Thermacore Report, March 1994.**

A high temperature/high pressure/high power density industrial prototype gas cell power generator which produced 50 watts of power at 300 °C having a nickel surface area of only 300 cm^2 was successfully developed. A sample of the nickel tubing of the aqueous potassium carbonate permeation cell was analyzed by XPS at the Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA. A broad peak centered at 54.6 eV was present; whereas, the control nickel tube showed no feature. The binding energy (in vacuum) of H(n = 1/2) is 54.4 eV. Thus, the theoretical and measured binding energies for H(n = 1/2) are in excellent agreement. No excess energy or 54.6 eV feature were observed when sodium carbonate replaced potassium carbonate.

7. **Gernert, N., Shaubach, R. M., Mills, R., Good, W., "Nascent Hydrogen: An Energy Source," Final Report prepared by Thermacore, Inc., for the Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base, Contract Number F33615-93-C-2326, May, (1994).**

In a report prepared for the <u>Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base, Thermacore</u> reports, "anomalous heat was observed from a reaction of atomic hydrogen in contact with potassium carbonate on a nickel surface. The nickel surface consisted of 500 feet of 0.0625 inch diameter tubing wrapped in a coil. The coil was inserted into a pressure vessel containing a light water solution of potassium carbonate. The tubing and solution were heated to a steady state temperature of 249 °C using an I^2R heater. Hydrogen at 1100 psig was applied to the inside of the tubing. After the application of hydrogen, a 32 °C increase in temperature of the cell was measured which corresponds to 25 watts of heat. Heat production under these conditions is predicted by the theory of Mills where a new species of hydrogen is produced that has a lower energy state than normal hydrogen. ESCA analysis, done independently by <u>Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA</u>, have found the predicted 55 eV signature of this new species of hydrogen."

6. **Wiesmann, H., Brookhaven National Laboratory, Department of Applied Science, Letter to Dr. Walter Polansky of the Department of Energy Regarding Excess Energy Verification at Brookhaven National Laboratory, October 16, 1991.**

Calorimetry of continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cell by Noninski at <u>Brookhaven National Laboratory</u>. Dr. Weismann observed the experiment and reported the results to Dr. Walter Polansky of the U. S. Department of Energy. Dr. Weismann reports, "The claim is as follows. The temperature rise in the dewar is greater in the case of electrolysis as compared to using

a resistor, even though the power dissipated is equal in both cases. According to Dr. Mills' theory, this apparent "excess power" is due to the fact that the electron in a hydrogen atom can "decay" to stable subinteger quantum levels. Dr. Noninski demonstrated this thermal effect at BNL." The observed rise in temperature for a given input power was twice as high comparing electrolysis versus heater power.

5. Nesterov, S. B., Kryukov, A. P., Moscow Power Engineering Institute Affidavit, February, 26,1993.

The Moscow Power Engineering Institute experiments showed 0.75 watts of heat output with only 0.3 watts of total power input (power = VI) during the electrolysis of an aqueous potassium carbonate electrolyte with a nickel foil cathode and a platinized titanium anode. Excess power over the total input on the order of 0.45 watts was produced reliably and continuously over a period of three months. Evaluation of the electrolyte after three months of operation showed no significant change in its density or molar concentration. The cell was disassembled and inspected after over one month of operation at 0.1 amperes. This inspection showed no visible signs of a reaction between the electrodes and the electrolyte. The cell was re-assembled and operated as before. Excess energy was produced for the three month duration of the experiment. Scintillation counter measurements showed no signs of radiation external to the cell.

4. Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University Bethlehem, PA, November 1993.

Samples of the nickel cathodes of aqueous potassium carbonate electrolytic cells and aqueous sodium carbonate electrolytic cells were analyzed by XPS by Miller and Simmons of the Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA. A broad peak centered at 54.6 eV was present only in the cases of the potassium carbonate cells. The binding energy (in vacuum) of H(n = 1/2) is 54.4 eV. Thus, the theoretical and measured binding energies for H(n = 1/2) are in excellent agreement. Lehigh University has conducted an extensive investigation of the cathodes from heat producing as well as those from control cells. Miller concludes that

"I was unable to find any other elements on the surface that cause the feature. The persistent appearance of a spectral feature near the predicted binding energy for many of the electrodes used with a K electrolyte is an encouraging piece of evidence for the existence of the reduced energy state hydrogen".

3. **Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993.**

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, November 1993] were confirmed at Idaho National Engineering Laboratory (INEL). Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA [Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994]. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of cathodes of potassium carbonate electrolytic cells [Craig, A., Y., Charles Evans & Associates XPS/ESCA Results, CE&A Number 44545, November 3, 1994]. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

2. **Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994.**

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair

Laboratory, Lehigh University, Bethlehem, PA, November 1993] were confirmed at Idaho National Engineering Laboratory (INEL) [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993]. Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of cathodes of potassium carbonate electrolytic cells [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993]. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

1. **Craig, A., Y., Charles Evans & Associates XPS/ESCA Results, CE&A Number 44545, November 3, 1994.**

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, November 1993] were confirmed at Idaho National Engineering Laboratory (INEL) [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993]. Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA [Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994]. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of

cathodes of potassium carbonate electrolytic cells. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

Given Applicant's full compliance with the new standards imposed by Specialist McGinty during the February 11, 2003 Interview, which required independent validation of the experimental evidence of record, Applicant is entitled to have this evidence accepted as reliable and to have this and other BlackLight applications issue as patents.

Examiner Langel's Reaffirmation of the Utility and Operability of Applicant's Novel Hydrogen Technology and His Subsequent Resignation From Examining BlackLight Cases "For Moral and Ethical Reasons"

Pursuant to the representations and agreements made during the February 11, 2003 Interview (reprinted below), Applicant followed up by submitting much of the independently generated scientific evidence cited above in two pending BlackLight applications and arranging an Interview with Examiner Langel, who was assigned to those cases and supposedly had full authority to issue them. [U.S. Serial Nos. 09/110,678 ('678 application) and 09/362,693 ('693 application).] The express purpose of the Interview, held on April 14, 2003, was to review those two applications on a claim-by-claim basis to ensure that the scientific data presented adequately supported the scope of the claims. Examiner Langel expressed once again his view that the claims of the two applications were adequately supported by the data and, therefore, those claims were allowable.

A detailed account of the discussions Applicant's counsel, Jeffrey Melcher and Jeffrey Simenauer, had with Examiner Langel during the April 14, 2003 Interview, and with Examiner Langel and his supervisor, SPE Stanley Silverman, during follow-up telephone Interviews were documented in Supplemental Responses filed in the '678 and '693 applications, comments from which are reproduced below. Based on the shocking revelations divulged during these discussions, Applicant must once again protest in the strongest terms possible the manner in which an anonymous group of

PTO officials (*i.e.*, the "Secret Committee") has mishandled the examination of BlackLight's patent applications relating to Applicant's novel hydrogen technology.

Counsel was particularly distressed to learn that when Examiner Langel met with Supervisor Silverman to advocate allowing the '678 and '693 applications to issue as patents, his supervisor informed him that "allowance is not an option." Despite the Examiner's careful study of the overwhelming weight of the scientific data supporting allowance, his supervisor further instructed him to "make it appear as if you have authority [to allow the applications] and that you are in favor of full rejection."

Understandably, Examiner Langel felt uneasy having been asked to make representations on the record that were not true. He explained that, "for moral and ethical reasons," he had no choice but to allow himself to be removed from examining all assigned BlackLight applications. Although Supervisor Silverman admitted that the removal decision had been made "partially by [him] and partially by others," he would not reveal who those "others" were.

Applicant strongly objects to Examiner Langel's removal under these egregious circumstances and demands that the PTO reinstate him immediately and allow BlackLight's applications to issue. The Secret Committee is duty bound to honor the representations and agreements made by Quality Assurance Specialist Douglas McGinty during the February 11, 2003 Interview, declaring that:

    (1) Examiner Langel and the other Examiners of record have "full authority" to review the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties and, based on that review, to issue patents as deemed appropriate;

    (2) Applicant should confer with the Examiners, either by telephone or in person, to review each assigned application on a claim-by-claim basis to ensure that the scientific data presented adequately supports the scope of the claims; and

    (3) for those claims determined to be adequately supported by the data, a patent will issue; for any claims deemed to be inadequately supported, Applicant reserves the right to continue seeking that broader claim coverage in subsequent proceedings. [See March 6, 2003 Response filed in the '678 application.]

It was precisely because of the many prior abuses that led to this short-lived "breakthrough" that U.S. Congressman David Wu sent his Senior Legislative Assistant, Ted Liu, to attend the February 11 Interview. Prior to the Interview, a senior PTO official alleged to Mr. Liu that there was no "Secret Committee." At the Interview, Mr. Liu witnessed not only Specialist McGinty's representation that Examiner Langel had the authority to allow BlackLight's applications, but the Examiner's unequivocal statement that the applications were, in fact, allowable and that he was prepared to issue Applicant his patents right then and there. [See *supra* and Attachment P.]

Despite those representations, an anonymous group of individuals has now declared that allowance is not even an option in BlackLight's cases. Worse yet, this Secret Committee sought to leave the false impression on the record that Examiner Langel—and perhaps other Examiners of record—had the authority to allow BlackLight's applications, and that he favored the rejection of claims over allowance.

In view of this unfortunate incident, which is described in greater detail below, Applicant is entitled to a complete accounting of events leading to Examiner Langel's removal, including identification of all persons involved in making that decision.

Detailed Account of the April 14, 2003 Interview and Subsequent Discussions

As stated above, the express purpose of the April 14, 2003 Interview was to review the scientific data generated and furnished by independent third parties identified in the March 6, 2003 Response that was filed in the '678 and '693 applications in support of the lower energy states of hydrogen and to ensure that the data adequately supported the scope of the claims to secure their allowance.

Applicant had no reason to suspect that this new approach, as agreed to during the prior February 11, 2003 Interview, was about to be completely scrapped. During the subsequent April 14, 2003 Interview, Examiner Langel once again reaffirmed his long-held opinion that the scientific data submitted by Applicant confirmed the operability of his novel hydrogen technology, thus warranting patent protection. The Examiner's comments made clear that, prior to the interview, he had extensively reviewed Applicant's data, as well as the summary statements characterizing that data, appearing in the prior Responses filed in the '678 and '693 applications. Based on that review,

Examiner Langel expressed several times during the Interview his willingness to allow those cases. Those views were confirmed by the Examiner in his interview summary, which stated that "[t]he participants presented data establishing the existence of lower-energy hydrogen." [See April 14, 2003 Interview Summary Form filed in the '678 and '693 applications (Attachment F).]

Examiner Langel, however, refrained from indicating allowance of any specific claims for two stated reasons. First, a few items of submitted data summarized in the March 6 Response inexplicably could not be located in the PTO files. The Examiner wanted time to confirm the data had been made of record, as well as Applicant's description of its relevance. Second, despite Specialist McGinty's representation at the February 11 Interview that Examiner Langel had full authority to review the data and to issue claims in the two interviewed cases, the Examiner explained that he needed to advise him and Supervisor Silverman of his intention to do so.

Examiner Langel then recalled a recent visit to his office by Group Director Jacqueline Stone informing him—again, contrary to what Applicant was told at the February 11, 2003 Interview—that he did not have authority to issue Notices of Allowance, or to otherwise give indications of allowance, in any BlackLight applications. Director Stone instructed Examiner Langel that he would need Specialist McGinty's permission before doing so.

Examiner Langel did, however, note that Supervisor Silverman and Specialist McGinty had agreed before the February 11 Interview to allow claims if Applicant could show that his submitted scientific data was generated by independent third parties. The Examiner reassured counsel that he would present to his superiors the scientific data discussed at the April 14 Interview with a recommendation of allowance consistent with his past views.

Applicant's counsel agreed that it made sense to allow time for Examiner Langel to discuss the case with his superiors and for counsel to resubmit the few missing items of scientific data, whereupon arrangement was made to continue with the personal Interview on the following day, April 15th. That morning, however, counsel received a distressing telephone message from Examiner Langel that the Interview had been

canceled. The Examiner stated that Supervisor Silverman had removed him from the subject cases and that he was no longer assigned to any BlackLight applications.

Applicant's counsel immediately telephoned Examiner Langel for a further explanation of what had happened. The Examiner confirmed his removal following the meeting he had arranged with Supervisor Silverman to discuss the scientific data that had been the subject of the previous day's Interview and to advocate allowance of the claims in the two subject applications. Examiner Langel informed counsel that his supervisor refused to even look at the data and, in response to his recommendation of allowance, Supervisor Silverman told him "allowance is not an option." According to Examiner Langel he was then told: "Make it appear as if you have authority [to allow the applications] and that you are in favor of full rejection."

Examiner Langel explained that, regrettably, he had no choice but to resign from further examination of BlackLight's applications. According to the Examiner, Supervisor Silverman gave him the option of staying on, "but not really—I could not go on like this." He explained that "for moral and ethical reasons," he could no longer continue to examine his assigned cases.

Alarmed by this sudden turn of events, counsel called Supervisor Silverman the following day, April 16th, to protest Examiner Langel's removal and to seek his reinstatement. Supervisor Silverman confirmed that Examiner Langel would no longer be examining Blacklight's patent applications and that all of its cases were in the process of being consolidated and transferred to a new Examiner.

Counsel kindly requested that Supervisor Silverman explain why those cases were being transferred and who made that decision. He initially refused to discuss the matter, saying only that, "I am not going to be put on the stand and cross examined on this." Upon further prodding, Supervisor Silverman volunteered that "the decision was made partially by me and partially by others." He refused, however, to be more specific when asked to identify the "others" involved in the decision, stating "I am not going to discuss that. You can say that it was *my* decision."

Counsel then informed Supervisor Silverman of Applicant's intention to file an objection to Examiner Langel's removal and to the consolidation and transfer of BlackLight's applications to a new Examiner. Counsel explained that Applicant had

expended enormous amounts of time and money over a period of many years prosecuting BlackLight's patent applications before Examiner Langel and getting him up to speed on the claimed technology and the extensive scientific data confirming its operation. Counsel argued that it was unfair to remove Examiner Langel and transfer all of BlackLight's cases to a new Examiner just to begin the process all over again. Supervisor Silverman would hear none of it, again stating, "I'm not going to discuss it."

Applicant's counsel made one last attempt to learn the identity of the other PTO officials responsible for taking this drastic action and their reasons for doing so. Supervisor Silverman again refused this request for information, snapping at counsel, "You figure it out!" Counsel then asked the Supervisor whom they might talk to so they could "figure it out" as he had put it. Supervisor Silverman advised counsel, "Talk to whomever you want," but when asked whom specifically he had in mind, he again retorted, "I don't like to be cross-examined."[125]

At the end of the conversation, Supervisor Silverman attempted to justify the PTO's extreme actions by claiming that it was in the "best interest" to transfer the applications. But, when asked by counsel whose best interest was being served by the transfer, he refused to answer. Supervisor Silverman, however, did offer the stunning revelation that Applicant's novel hydrogen technology was "beyond Examiner Langel's technical expertise" and that all of BlackLight's cases would be consolidated and transferred to another examiner with "more technical expertise." He would not elaborate on who this new, more highly qualified Examiner might be.[126]

Needless to say, at no time during the five years Applicant had been prosecuting his patent applications before Examiner Langel—who has over thirty years of Patent Office experience—did his technical expertise ever come into question. Indeed,

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[125] Counsel has taken steps "to figure it out" and expressly reserves the right to further supplement the objections raised herein as additional facts come to light. (Attachment R)

[126] All of BlackLight's applications have now been consolidated under the direction of a newly identified Examiner, Dr. Bernard Eng-Kie Souw, whose views have been adopted by the Committee in rejecting Applicant's cases in the name of four Examiners: Examiners Kalafut, Tsang-Foster, Wells, and Tanner. Applicant notes, however, that Dr. Souw is far less experienced in patent matters than his predecessor, Examiner Langel. Furthermore, as discussed in detail below, Dr. Souw's views are not only technically inaccurate, but are also tainted due to a genuine conflict of interest based on his involvement in questionable outside business activities while examining Applicant's cases.

throughout the lengthy prosecution of these cases, counsel has been impressed with the Examiner's in-depth knowledge of chemistry and physics, as well as other scientific principles, underlying Applicant's technology. That Supervisor Silverman would raise Examiner Langel's technical competence as an issue at such a late stage of that prosecution only heightens Applicant's suspicions as to the real motivation for removing Examiner Langel.

Immediately following the conversation with Supervisor Silverman, counsel telephoned Examiner Langel one last time to apprise him of the situation and to thank him for his many years of service in examining BlackLight's applications. Examiner Langel expressed regret over his removal from those cases and confirmed that he had "learned a lot about [BlackLight's] technology." The Examiner also expressed surprise that his expertise was now being called into question.

Examiner Langel shared counsel's exasperation over the situation. Counsel asked him if he knew of any other instances in which a PTO Examiner had been instructed to represent that he had authority to allow an application when, in fact, he had no such authority, and that he favored rejecting claims when he actually wanted to allow them. The Examiner's exact words were: "I've never seen anything like it."

Frankly, neither has Applicant's counsel and, in view of these unique circumstances, Applicant must once again strenuously object to the abusive treatment to which his applications have been subjected.

**The Secret Committee Has Demonstrated Extreme Bias In Its Handling
of BlackLight's Patent Applications Due to a Genuine Conflict of Interest**

Following Examiner Langel's unfortunate resignation from examining BlackLight's applications, the Committee consolidated those cases under a new, allegedly more experienced Examiner. Consequently, the Committee's rejections of Applicant's claims in this and other pending BlackLight applications based on inoperability due to the alleged non-existence of lower-energy hydrogen now rely heavily, if not almost exclusively, on the views expressed by that new Examiner, Dr. Bernard Eng-Kie Souw. Indeed, Dr. Souw is known to have prepared on behalf of the Committee over one

hundred pages of arguments, which in one form or another, have now found their way into all of BlackLight's cases forming the basis for the Committee's erroneous rejections.

As explained in more detail below, Dr. Souw's involvement in shaping the Committee's views in this case has raised serious concerns regarding the bias of those views due to a genuine conflict of interest. As Applicant has shown, that conflict arises out of Dr. Souw's continuing work as the lead scientist for a company he owns that provides consulting services and conducts research in the same technical fields as Applicant while Dr. Souw simultaneously examines Applicant's pending patent applications. Because Dr. Souw's biased views have so tainted the present rejections, the Committee must immediately withdraw those rejections so that the pending claims can be allowed to issue.

Rather than address the issues surrounding the impropriety of Dr. Souw's outside business interests, the Committee initially denied the existence of a conflict by falsely claiming that Dr. Souw's company was merely a former employer of the Examiner. Faced, however, with Applicant's incontrovertible evidence of Dr. Souw's continuing role as owner and lead scientist for BMS, the Committee took several new, and often inconsistent, positions in subsequent Office Actions that were no more convincing. In its latest arguments denying the existence of a conflict, the Committee contradicts itself yet again, this time by recognizing the operability of BlackLight's technology in terms of its use of hydrinos, as distinguished from BMS's related technology, which it claims "do[es] not necessarily require the use of hydrinos."

Having made that distinction, the Committee cannot have it both ways. It must either: (1) drop the § 101 and § 112 rejections in all pending BlackLight applications in recognition of the operability of its hydrino technology; or (2) concede that there is no significant difference between the technical fields practiced by BMS and BlackLight and therefore, that examination of BlackLight's cases by the current founder and lead scientist of BMS creates a genuine conflict of interest.

The Committee's Continued Refusal To Disclose the Details of Dr. Souw's Employment History Raises Serious Questions Of Whether It Is Capable Of Fairly Examining Applicant's Cases

The Committee's appointment of Dr. Souw came at a critical juncture in the examination of Applicant's pending cases. As explained above, in April 2003, Examiner Langel, one of the two original examiners assigned to these cases, had resigned from his examining duties "for moral and ethical reasons." Examiner Langel's abrupt resignation came after being instructed to misrepresent that he favored denying Applicant his patents when the record showed he wanted to allow those patents to issue, and that he had authority to grant such allowance when, in fact, he was told that "allowance is not an option."

To justify Examiner Langel's resignation after the fact, the PTO informed Applicant that his cases were being transferred and consolidated under the direction of an Examiner with "more technical experience." A few short weeks later, Dr. Souw began making appearances in Applicant's cases even though he had only a few years of experience as an Associate Examiner, as compared to Primary Examiner Langel, who had over thirty years of PTO examining experience. [See Appendix attached to the Committee's May 7, 2003 Office Action issued in U.S. App'n Ser. No. 09/513,768 ('768 application).] The questionability of the Committee's move is further demonstrated by Examiner Langel's far superior technical understanding of Applicant's technology, as compared to the erroneous arguments that permeate Dr. Souw's Appendices.

Applicant was naturally suspicious of Dr. Souw's prominent membership on the Committee given the abusive treatment Applicant has suffered during the examination of his pending applications, as already discussed. As further explained below, this new appointment prompted Applicant to raise initial questions regarding Dr. Souw's employment history after he first showed bias in examining these cases by citing his own technical papers against Applicant. Rather than answer those questions, the Committee stonewalled once again, defensively arguing that:

> [T]he employment history of examiners, including those acting in a consulting role, is irrelevant to the examination thereof, except where there is a genuine conflict of interest. [See 4/14/04 Office Action in U.S. App'n Ser. No. 09/008,947 at p. 5.]

Dr. Souw has been similarly uncooperative, although he did provide some limited information regarding his employment history by citing to his background in microwave

plasmas based on work he did almost two decades ago:

> Since the cited Examiner's papers cannot possibly have been criticized by Applicant, citing his own publication(s) does not make the Examiner's view "biased", as alleged by Applicant. In the contrary, such technical papers provide a solid evidence that the Examiner is in possession of sufficient background for evaluating Applicant's claimed invention. In this regard, the Examiner can add a further evidence of strong background in microwave plasmas generated in a resonance cavity similar to those used by Applicant, not only in theory, but also hands-on in its design, construction and routine operation, as well as in its spectroscopy, both low and high resolutions [1]. [Souw Appendix at p. 4 attached to the March 29, 2004 Office Action filed in the '768 application.]

The reference [1] cited by the Examiner as evidence of his supposed "strong background in microwave plasmas" is an article published in March 1987: Souw, Eng-Kie, Plasma density measurement in an imperfect microwave cavity, J. Appl. Phys. 61 (5), 1 March 1987.[127]

The Committee's defensive remarks regarding the irrelevancy of Dr. Souw's employment history, when contrasted with the Examiner's own remarks extolling the relevancy of that history, are truly astounding. The Committee's statements are even more remarkable in light of additional information that has come to Applicant's attention concerning Dr. Souw's engagement in questionable business activities that began before, and has continued after, all of BlackLight's pending applications were consolidated and assigned to Dr. Souw.

This information came to light only after Applicant, unable to get straight answers from the Committee regarding Dr. Souw's background, undertook his own investigation into the Examiner's employment history. That investigation uncovered a much more recent 2003 article authored by Dr. Souw, in which he admits that he works as the lead scientist for a consulting company that he co-founded, BMS Enterprise (BMS) in Herndon, Virginia, at the same time he works for the PTO examining BlackLight's

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[127] Ironically, Dr. Souw attempts to establish his credibility in evaluating Applicant's novel hydrogen technology by citing his peer-reviewed article published in the *Journal of Applied Physics*, yet argues that Applicant's article published in that very same journal does not deserve similar credibility. In taking those contradictory positions, the Committee reveals yet another double standard that only reinforces its obvious bias against Applicant.

applications. [Attachment S] Dr. Souw also admits in the article that his business activities for BMS includes work in at least two technical areas, which are identical to, and therefore compete with, those practiced by BlackLight.[128]

Given that one of those technical areas is microwave plasmas, it is highly suspicious that the Committee and Dr. Souw withheld this highly relevant, up-to-date work experience in support of his supposedly "strong background in microwave plasmas," citing instead an outdated 1987 article in support. The Committee's withholding of this critically important information lends support to Applicant's showing that Dr. Souw's ownership of, and work for, an ongoing business enterprise in competition with Applicant while examining his pending patents applications, in clear violation of the PTO's own ethics rules, constitutes a genuine conflict of interest. As a consequence, the ability of the Committee under the direction of Dr. Souw to fairly evaluate the merits of Applicant's novel hydrogen technology, yet again, has been called into serious question.

The above-mentioned article was published in *Optical Engineering* on November 2, 2003. [Souw, Bernard Eng-Kie, Coherent telescope array with self-homodyne interferometric detection for optical communications, Opt. Eng. 42(1) 3139-3157 (November 2003) (Attachment S).] As the author of that article, Dr. Souw prominently identifies himself on the first page (p. 3139) and his association with BMS as follows:

> Bernard Eng-Kie Souw
> BMS Enterprise
> P.O. Box 5524
> Herndon, Virginia 20172-5524
> E-mail: souw1@juno.com

The last page of the article (p. 3157) is particularly informative as it summarizes Dr. Souw's technical background and work experience establishing his connection to BMS as its co-founder and lead scientist. Applicant reproduces the following relevant portions of that background summary, which notably describes BMS as providing

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[128] Incredibly, since the time Applicant first brought this information to the PTO's attention in his October 14, 2004 Response filed in U.S. Patent App'n Ser. No. 09/008,947, and subsequently in other pending cases, not only has the PTO failed to seriously address the issues raised, but it continues to cite and rely on Dr. Souw's biased arguments. These actions leave Applicant no choice but to seek other avenues of relief from this unfair treatment.

consulting services in two main technical areas, microwave plasma devices and CVD

diamond synthesis and applications, that are identical to those practiced by BlackLight:

> In 1985, [Bernard Eng-Kie Souw] joined Brookhaven National Laboratory (BNL) in Long Island, New York as staff member in a Star Wars project. He was awarded a Department of Energy research grant in 1993 and became Principal Investigator in a research and development project on a novel, solar blind and fieldable alpha-beta-gamma radiation detector in collaboration with Northrop-Grumman and New Jersey Institute of Technology. **About the same time he cofounded BMS Enterprise, a multi-interdisciplinary consulting company providing services mainly in microwave plasma devices and CVD diamond synthesis and applications. He left BNL in 1997 and became a patent examiner with the US Patent and Trademark Office in Arlington, Virginia until 2000, when he joined ITT Industries in Reston, Virginia as a scientist and engineering specialist in optical communications. He left ITT in 2002 to dedicate more time as lead scientist with BMS Enterprise.** [Emphasis added.]

As the Committee is no doubt aware, Applicant's novel hydrogen technology has

many potential commercial applications, including the aforementioned microwave

plasma devices and CVD diamond synthesis. Indeed, Applicant presently has on file

two copending applications directed to these specific art areas. [See U.S. App'n Ser.

No. 10/469,913, filed March 7, 2002; and PCT/US/13412, filed May 1, 2002.] Applicant

has serious concerns that the overlap of these and other competitive technologies that

BMS and BlackLight engage in may have affected, and will continue to affect, Dr.

Souw's examination and rejection of BlackLight's applications on behalf of the

Committee.

This situation is particularly disturbing in light of PTO ethics rules that prohibit

patent examiners from engaging in outside business activities that conflict with their

assigned administrative duties. [See *Summary of Ethics Rules* for the U.S. Patent and

Trademark Office published by the U.S. Department of Commerce, Office of the

General Counsel, Ethics Division (2000) (Attachment S).] As the introductory paragraph

to these ethical rules makes clear, the issue involved here is one of public trust:

PUBLIC SERVICE IS A PUBLIC TRUST

As an employee of the U.S. Patent and Trademark Office you have been placed in a position of trust and are held to a high standard of ethical conduct. This handout contains a summary of the rules set forth in conflict of interest statutes and the *Standards of Ethical Conduct for Employees of the Executive Branch.* [Ethics Rules at p. 1 (Attachment S).]

To hold examiners to this high standard of ethical conduct, the rules prohibit activities that would create a financial conflict of interest:

Financial Conflicts of Interest. You <u>may not</u>, as part of your official Government duties, participate in any matter that will have a direct and predictable effect on your personal financial interest, unless an exemption applies. This rule applies to matters involving specific parties in which you have a financial interest and to broad policy matters that affect many entities, including ones in which you have an interest (such as a policy affecting an entire industry sector if you have stock holdings in one of the companies in the industry sector). [Ethics Rules at p. 2 (Attachment S) (emphasis in original).]

Other PTO ethic rules govern outside employment activities:

General Rule on Outside Activities. You <u>may not</u> engage in outside employment or any other personal activity that conflicts with your Department position, including employment that requires disqualification from a significant part of your Government duties or an activity that creates an appearance of using your public office for private gain. You must disqualify yourself from participating in a matter as a Department employee which may affect the financial interests of an outside employer or in which an outside employer, or an organization in which you are an active participant, is a party or is representing a party. . . . [Ethics Rules at p. 5 (Attachment S) (emphasis in original).]

These restrictions against financial conflicts of interest and outside employment activities are further amplified with specific reference to patent examiners in the following rules:

Financial conflicts of Interest

<u>Conflicts of Interests regarding Patent Examiners</u> If you are a patent examiner, you may not participate in the review of any patent if you have a financial interest in a company that may be affected by the issuance or denial of the patent (unless your interest is in publicly-traded stock valued

at $5,000 or less in all affected companies). . . . [Ethics Rules at p. 10 (Attachment S).]

Outside Employment and Activities

<u>Service with Non-Federal organizations</u> If you serve as an officer or director of an outside organization, such as a professional association, you <u>may not</u> participate as a USPTO employee on any matter that is likely to affect the financial interests of the organization. This may preclude you from serving with organizations that are active in matters before your office. If it would benefit USPTO to have an official relationship with a private organization, you may be assigned as a liaison to the organization, in which case your service with the organization would be in an official capacity, rather than as an outside activity. However, you may not be assigned to service in an official capacity as an officer or director of a non-Federal organization (other than a standards-setting body). [Ethics Rules at p. 11-12 (Attachment S) (emphasis in original).]

The applicability of these ethics rules to the present situation cannot be seriously disputed. Dr. Souw was employed as a PTO Examiner at the same time he admits to working as the lead scientist for BMS with an apparent ownership stake in the company, which has a competing interest with BlackLight. Indeed, records indicate that Dr. Souw was a PTO employee prior to the date *Optical Engineering* first received his BMS article on February 6, 2003, and throughout the time that paper was being revised and received on May 6, 2003, and ultimately published on November 2, 2003.[129]

The article's May 6, 2003 revision date is particularly significant. It was only <u>one</u> day later, on May 7, 2003, that the Committee began issuing rejections in BlackLight's pending cases based on Appendices authored by Dr. Souw, starting with the '768 application. Dr. Souw's genuine conflict of interest in working for BMS during his employ as a PTO examiner—and while rejecting a competitor's patent applications no less—should be obvious to any fair-minded person and, thus, requires no further discussion.[130]

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[129] See, for example, U.S. Patent No. 6,506,648, issued January 14, 2003, which identifies Bernard Souw as the Assistant Examiner. Based on established PTO procedures, Examiner Souw is believed to have been a PTO employee when the Notice of Allowance was issued in that case, well before January 2003.

[130] Interestingly, Dr. Souw mentions in his article that he co-founded BMS in 1993 while working for BNL and that he left BNL in 1997 to join the PTO, apparently while still operating BMS. According to the article, Dr. Souw then left the PTO in 2000 to join ITT Industries as a scientist/engineer in the optical communications field until 2002, when he left "to dedicate <u>more</u> time as lead scientist with BMS Enterprise." [Emphasis added.] Notably, however, Dr. Souw fails to mention in the BMS article his

This clear conflict of interest is especially troubling given the many other questionable activities that have occurred in the prosecution of BlackLight's applications as documented and described above, including:

(1) the withdrawal from issue of five allowed BlackLight applications under highly suspicious circumstances involving interference by Dr. Robert Park, spokesman for the American Physical Society (APS), a BlackLight competitor;

(2) the admission by Dr. Park's APS colleague, Dr. Peter Zimmerman, that Dr. Park has a "Deep Throat" contact at the Patent Office who has provided him with information concerning BlackLight applications;

(3) the rejection of Applicant's claims based on a non-peer reviewed article posted on an Internet bulletin board authored by Dr. Zimmerman, who has bragged that while working at the State Department his agency and the Patent Office "have fought back with success" against BlackLight;

(4) Dr. Zimmerman's improper contact of scientific journals in an attempt to prevent Applicant from meeting the publication requirement imposed by the Committee before his experimental evidence would even be considered; and

(5) Examiner Wayne Langel's untimely resignation from the examination of BlackLight's applications for "moral and ethical reasons" after being

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apparent re-employment by the PTO, which failure, incidentally, does comply with at least one PTO ethics rule: "you may not use your Government title in connection with a non-Government activity." [[Ethics Rules at p. 7 (Attachment S) (emphasis in original).]

Also somewhat troubling is that Dr. Souw apparently continues to examine and issue applications in other art areas that overlap with his scientific work for BMS, including optical communications, which is the subject matter of his published article. [See, e.g., U.S. Patent No. 6,801,676, filed June 24, 2003 and issued October 5, 2004, on a "Method and apparatus for phase shifting an optical beam in an optical device with a buffer plug" (recognizing in the "Background of the Invention" section that "the need for fast and efficient optical-based technologies is increasing as Internet data traffic growth rate is overtaking voice traffic pushing the need for optical communications.")]

told to materially misrepresent the record and that "allowance is not an option" in these cases.

In view of this sordid prosecution history, Applicant is understandably outraged by the discovery that following Examiner Langel's unfortunate resignation, the Committee appointed Dr. Souw to continue carrying out its "allowance is not an option" policy while he owned and operated a competing business interest. Applicant has demanded several times that the PTO provide a complete accounting of the facts and circumstances surrounding prior questionable activities, including those summarized above. Applicant has made a similar demand for information in connection with this latest episode involving Dr. Souw's conflicted association with BMS while assigned to examine and reject BlackLight's pending patent applications. Applicant now repeats that demand for information here, including but not limited to a full disclosure of the facts and circumstances relating to:

(1) Dr. Souw's appointment as an examiner assigned to review BlackLight's pending patent applications;

(2) his outside business activities with BMS Enterprise, and with any other business ventures in which he has a financial stake or other personal interest;

(3) his contacts with any sources outside the PTO regarding the subject matter disclosed in any of BlackLight's applications; and

(4) his membership activities, or any other participation, in any professional organizations, including the APS.[131]

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[131] This information is deemed relevant to the following additional PTO ethics rule:

Appearances of Bias (non-Financial Conflicts of Interest)

Participation in Professional Organizations If you are an active member of a professional organization, such as a member of a[n] association of attorneys or patent professionals, you will be barred from participating in USPTO on matters in which that organization is a party or is representing a party. If this will interfere with your USPTO duties, you should refrain from such activities or should seek advice from the Ethics Division. . . . [PTO Ethics Rules at p. 10 (Attachment S).]

Unfortunately, like Applicant's many other reasonable information requests, this one too has been ignored by the Committee despite the serious implications of Dr. Souw's outside business activities in establishing a genuine conflict with his examination of BlackLight's pending cases. The Committee's repeated refusals to honor these requests, however, merely raise further suspicion that it is withholding information that would reinforce Applicant's already strong showing of a conflict in those cases.

When not withholding information, the Committee tries to obscure the facts by advancing irrelevant and inaccurate information that contradicts Dr. Souw's own admissions:

> Applicant's remarks concerning examiner Souw, and the article (Attachment S) are noted. This article deals with a telescope array, and does not appear to show any conflict of interest between Dr. Souw's former employer, BMS Enterprise, and his consulting involvement with the present application. [See, e.g., December 21, 2004 Advisory Action filed in U.S. App'n Ser. No. 09/362,693 at p. 2 (emphasis added).]

The Committee's carefully worded denial of Dr. Souw's obvious genuine conflict of interest only raised further suspicions by its failure to even address Applicant's basis for asserting the conflict. While the Committee claims to have noted Applicant's remarks regarding this issue, it is apparent from its initial brief response that, true to form, those remarks were wholly ignored.

The Committee's refusal to seriously address the conflict in this case is clear from its narrow focus on the subject matter of the Souw article. Although the Committee correctly notes that the article "deals with a telescope array," that fact is totally irrelevant and, thus, cannot possibly support the Committee's conclusion that the article "does not appear to show any conflict of interest." [Emphasis added.]

Applicant has never relied on the subject matter of Dr. Souw's article as a basis for establishing a conflict in the present application. Rather, as previously discussed,

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As explained in detail above, and in previous Responses, Applicant has good reason to believe that the APS, and perhaps other professional organizations, have become involved as active participants in these proceedings.

that showing is based upon Dr. Souw's admission in the background summary of the article that he co-founded BMS Enterprise and has continued to operate the company as its lead scientist.[132] In that capacity, he works in two main technical areas— microwave plasma devices and CVD diamond synthesis and applications—identical to those practiced by Applicant while also employed by the PTO to examine and reject Applicant's cases. The Committee's initial refusal to even acknowledge that aspect of Applicant's showing of a genuine conflict of interest in this case, much less discuss it, is telling and only confirms Applicant's showing that a conflict does indeed exist.

The Committee attempts to gloss over Dr. Souw's startling admission that he operates a business enterprise that competes with Applicant's business interests while examining his cases by claiming that the subject matter of the article, i.e., a telescope array, does not establish a conflict of interest "between Dr. Souw's former employer, BMS Enterprise, and his consulting involvement with the present application." [Emphasis added.] Aside from being non-responsive, this argument is also factually inaccurate and only further confirms that a conflict of interest does indeed exist.

The Committee incorrectly refers to BMS as a "former employer," in contradiction to Dr. Souw's admissions that he co-founded BMS and, therefore, is presumably a principal owner of the company, and that he continues to operate the company while employed by the PTO as an Examiner. The Committee merely compounded its error based on the alleged "former employer" status of BMS with the unfounded conclusion that no conflict of interest exists between Dr. Souw's work for BMS as its lead scientist and his work for the PTO as the Examiner primarily responsible for examining Applicant's cases. In drawing this erroneous conclusion, the Committee all but admits the obvious—that Dr. Souw's current employment with BMS does in fact create a genuine conflict of interest, which then taints the Committee's rejections in those cases.

Perhaps realizing the incoherence of its initial response regarding the issue of Dr. Souw's apparent conflict of interest, the Committee, in a subsequent Office Action,

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[132] As footnoted above, Applicant's only reference to a conflict involving the subject matter of Dr. Souw's article, i.e. optical communications, revolves around his continued examination of other patent applicants' cases in that same art. This pattern of ignoring conflicts merely provides further support for, but does not form the basis of, Applicant's clear showing that Dr. Souw is also conflicted in this case based on his ongoing work for BMS, as disclosed in the article's background summary.

drastically changed its position. Although the Committee no longer tries to mischaracterize BMS as a "former employer," astonishingly, it now argues that Dr. Souw's <u>continued</u> operation of that company while he examined and rejected Applicant's patent applications does not create a conflict:

> Applicant also implies (page 108) that Dr. Bernard Souw, who has been consulted during the examination of his applications, is also involved in work "competitive" to this [sic] own, which would produce a conflict of interest. The evidence offered by applicant, an article written by Dr. Souw, deals with a telescope array, which is neither an alternative form of hydrogen nor a new previously unappreciated source of energy, and thus does not appear to be competitive with the present "hydrino" or any battery based thereon. While the biographical sketch at the end of the article mentions his involvement in consulting work having to do with microwave plasma devices and CVD diamond synthesis, this would not amount to competition with the present invention or the underlying hydrinos. Diamonds are a form of carbon, and thus are not in competition with hydrogen. Microwave plasma devices are not necessarily related to hydrogen, since they are a type of device or machine. [2/11/05 Office Action at page 4 filed in U.S. App'n Ser. No. 09/110,717.]

These arguments, which attempt to downplay Dr. Souw's conflicting business activities, are no more convincing than those previously posited and, in fact, raise so many new issues, Applicant hardly knows where to begin. First, Applicant did not "imply" anything; rather, he simply quoted relevant portions of Dr. Souw's own article admitting to outside business activities that clearly conflict with technologies practiced by Applicant whose pending patent applications Dr. Souw has examined and rejected. That alone is sufficient to establish a genuine conflict of interest that fatally taints the biased views of Dr. Souw adopted by the Committee.

Second, the Committee's comment regarding "the evidence offered by Applicant" is disturbing. It is not Applicant's responsibility to "offer" evidence that the Committee itself should have produced voluntarily. Worse yet, the Committee continues to withhold additional evidence in its sole possession responsive to Applicant's information requests regarding Dr. Souw's outside business interests, which evidence would likely shed further light on the conflict issue. If and when the Committee chooses to cooperate with Applicant by turning over the requested information, there is no telling what additional

genuine conflicts of interest will be revealed based on "the evidence offered by Applicant."

Third, as previously discussed, the Committee's reliance on the subject matter of the article, i.e., a telescope array, is a "red herring" that has absolutely nothing to do with the conflict issues surrounding Dr. Souw's questionable business activities. Applicant has never once asserted that Dr. Souw's work in the area of telescope arrays creates a genuine conflict of interest in this case. For the Committee to continue to raise this as an issue merely highlights the weakness of its position denying the existence of a conflict.

Fourth, the Committee uses strained reasoning in asserting that Dr. Souw's admission to his involvement in consulting work relating to microwave plasma devices and CVD diamond synthesis "would not amount to competition with the present invention or the underlying hydrinos." As explained above, and in other numerous responses, one direct application of the BlackLight's lower-energy hydrogen technology is CVD diamond synthesis, which subject is covered by claims in one of its pending patent applications. For the Committee to ignore this plain, simple fact and weakly argue instead that "[d]iamonds are a form of carbon, and thus are not in competition with hydrogen" merely demonstrates its refusal to take the conflict issue seriously. Similarly, the Committee's excuse that "microwave plasma devices are not <u>necessarily</u> related to hydrogen, since they are a type of device or machine" hardly merits a response. Again, the formation of microwave plasmas is a direct application of BlackLight's lower-energy hydrogen technology as Dr. Souw himself has recognized, and is covered in its pending patent applications. Dr. Souw has recognized as much by advocating that his prior work experience provides evidence of his "strong background in microwave plasmas generated in a resonance cavity similar to those used by Applicant." [See, for example, Souw Appendix at p. 4 attached to the March 29, 2004 Office Action filed in U.S. App'n Ser. No 09/513,768.] Dr. Souw's statement regarding his decades-old work in the field of microwave plasmas applies equally to his work today in that same field for BMS, yet, mysteriously, Dr. Souw and the Committee have tried their best to keep that experience secret. Why? The Committee's failure to

address these and other salient points establishing a conflict of interest only strengthens Applicant's case.

Fifth and finally, the PTO members of the Committee know better than anyone that direct competition between the Examiner and the Applicant whose case he is examining is not the proper standard used in determining whether a conflict of interest exists. Indeed, the PTO's own Ethics Rules, as discussed above, forbid an Examiner from engaging in outside employment activities that create even the appearance of impropriety:

> **General Rule on Outside Activities.** You may not engage in outside employment or any other personal activity that conflicts with your Department position, including employment that requires disqualification from a significant part of your Government duties or an activity that creates an appearance of using your public office for private gain. . . . [Ethics Rules at p. 5 (Attachment S) (emphasis in original).]

Incredibly, after initially withholding information about Dr. Souw's outside business activities, and then trying to pass him off as a former BMS employee, the Committee once again contradicts itself in a subsequently filed Office Action begrudgingly admitting that Dr. Souw, in fact, owns the company and, therefore, "may appear to have a conflict of interest." In making that admission, however, the Committee continues to blatantly disregard the PTO's own Ethics Rules in contending that this appearance of impropriety does not prevent Dr. Souw from examining Applicant's patent cases based on the absurd argument that he does not work on fuel cells in direct competition with Applicant:

> Applicant argues . . . that examiner Bernard Souw owns a company which provides consulting services in two technical areas, microwave plasma devices and CVD diamond synthesis. While an examiner with such outside employment may appear to have a conflict of interest, such a conflict can be avoided if he refrains from either working on applications dealing with these, or working on these things in his outside employment. The present application, however, is drawn to a fuel cell, which is outside those fields, and thus would not be in competition with any consultation therein. [Final Office Action dated July 18, 2005 issued in U.S. App'n Ser. No. 09/008,947.]

Like the Committee's previous attempts to cover up Dr. Souw's obvious conflict of interest, this one too must fail. Simply put, the presence or absence of direct competition is not the standard by which conflict of interest issues are to be judged. As noted above, the admitted <u>appearance</u> of a conflict is alone sufficient to disqualify Dr. Souw as an examiner in this case and exclude his biased arguments.

In any case, the Committee further admits by its own arguments that Dr. Souw's work for BMS on microwave plasma devices and CVD diamond synthesis overlaps with BlackLight's business interests and, therefore, denying BlackLight its patents, including one in this case, works to Dr. Souw's economic benefit. Contrary to the Committee's misguided view of the rules on ethics, such a conflict is not avoided by Dr. Souw's alleged non-competition in the narrowly drawn field of fuel cells.

Applicant suspects that the Committee's self-serving statements quoted above are narrowly confined to avoid disclosing the full scope of Dr. Souw's outside business activities, which information Applicant has repeatedly requested for years now without the courtesy of a response. The Committee, however, has no basis for asserting that Dr. Souw's outside business activities are limited to his work on microwave plasma devices and CVD diamond synthesis. Applicant knows for a fact that these are <u>not</u> the only two technical fields Dr. Souw engages in for BMS, as he himself admits in the background section of the journal article unearthed by Applicant's counsel:

> [Dr. Souw] cofounded BMS Enterprise, a <u>multi-/interdisciplinary</u> consulting company providing services <u>mainly</u> [i.e., not exclusively] in microwave plasma devices and CVD diamond synthesis and applications. [Souw, Bernard Eng-Kie, Coherent telescope array with self-homodyne interferometric detection for optical communications, Opt. Eng. 42(1) at 3157 (November 2003) (Attachment S) (emphasis and explanatory note in brackets added).]

That statement makes clear that there are other technical fields in which Dr. Souw provides services through his work for BMS. The Committee's refusal to disclose this important relevant information only fuels further suspicion that Dr. Souw is secretly engaged in other technologies that conflict with those practiced by Applicant.

Applicant is also suspicious of the Committee's carefully worded statement regarding Dr. Souw's work in the fields of microwave plasmas and CVD diamond synthesis and that Applicant's '947 application is "drawn to a fuel cell, which is outside those fields, and thus would not be in competition with any consultation therein." That statement is not an affirmative declaration that Dr. Souw has refrained from working in other technical fields that may also be common to those applications he has examined or otherwise provided input.[133]

The Committee's tenuous position in this regard is also shot down by Dr. Souw himself through his own incriminating statements. For example, before counsel's independent investigation uncovered Dr. Souw's conflicting business activities for BMS, Dr. Souw proudly touted his supposed "strong background in microwave plasmas" based on his prior work experience. According to Dr. Souw, that experience was highly relevant to his qualifications for examining the subject matter of Applicant's pending cases:

> In the contrary, such technical papers provide a solid evidence that the Examiner is in possession of sufficient background for evaluating Applicant's claimed invention. In this regard, the Examiner can add a further evidence of strong background in microwave plasmas generated in a resonance cavity similar to those used by Applicant, not only in theory, but also hands-on in its design, construction and routine operation, as well as in its spectroscopy, both low and high resolutions [1]. [Souw Appendix at p. 4 attached to the March 29, 2004 Office Action filed in the '768 application.]

By Dr. Souw's own admission, his present clandestine work for BMS then also provides further evidence of his strong background in microwave plasmas similar to those used by Applicant, thus raising a genuine conflict of interest. For the Committee to limit discussion of the relevant subject matter of Applicant's cases to "fuel cells," or any other technical field supposedly outside the scope of Dr. Souw's business activities—such as plasmas, for example—is simply nonsensical.

In apparent recognition of the weakness of its prior arguments denying a conflict, the Committee again tries to defend the indefensible by taking new positions in a

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[133] Of course, once a conflict of interest has been established in even one of Applicant's cases, that is a sufficient showing that Dr. Souw's bias has infected all of Applicant's cases in which his views appear.

subsequent Office Action. [*See, e.g.,* September 9, 2005 Office Action filed in App'n
Ser. No. 09/362,693; December 12, 2005 Advisory Action filed in App'n Ser. No.
09/110,694] The Committee, however, succeeds only in contradicting itself once again,
most notably by recognizing the operability of BlackLight's novel hydrogen technology,
which involves the use of hydrinos, as a basis for distinguishing Dr. Souw's work for
BMS:

> Applicant alleges a conflict of interest on the part of Dr. Bernard Souw,
> who has authored Appendices, and has been consulted during the
> examination of the present application, since Dr. Souw's consulting firm,
> BMS, would be a competitor of applicant's company, Blacklight. Applicant
> only shows that BMS has done consulting work in two fields in which
> applicant believes his invention to be applicable. However, these fields
> are microwave plasmas and CVD analysis, which do not necessarily
> require the use of hydrinos, while applicant's invention (in the present
> application) deal with methods of making compounds that include
> hydrinos, which do not use microwave plasmas or CVD. Even if these
> were competing fields, Dr. Souw would have the option of either
> withdrawing from working on the present application, or refraining from
> working on the competing subject matter outside of the PTO. [September
> 9, 2005 Office Action filed App'n Ser. No. 09/362,693 at p. 4; December
> 12, 2005 Advisory Action filed App'n Ser. No. 09/110,694 at pp. 3-4
> (emphasis added).]

Having been forced to recognize the operability of BlackLight's novel hydrogen
technology based on the required use of hydrinos to distinguish it from Dr. Souw's work
for BMS in attempting to avoid a conflict of interest,[134] the Committee is obliged to
withdraw its rejections of Applicant's claims under § 101 and § 112. Should it otherwise
maintain those rejections on the basis that hydrinos do not exist, the Committee must
then concede by its latest arguments that Dr. Souw's clandestine work for BMS is not
sufficiently distinguishable from Applicant's hydrogen technology to avoid a conflict.

The Committee's reliance on the existence of hydrinos to avoid Applicant's
conflict of interest charge, while appreciated, once again ignores the broad grounds
upon which that charge was based. The Committee notably still fails to address the
obvious economic benefit to Dr. Souw through BMS in denying BlackLight its patents on

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[134] That is not to say that the Committee necessarily avoids a conflict of interest based on Dr. Souw's
work involving the same technical subject matter as that of Applicant.

related technology and the Committee's duty to avoid even the <u>appearance</u> of impropriety under the PTO's Ethics Rules. In essence, the Committee is arguing that, for there to be a conflict of interest in this case, Dr. Souw's outside business activities would have to <u>infringe</u> patent claims he is assigned to examine were those claims to issue. That is clearly not the proper standard for evaluating whether or not a conflict of interest exists.

The Committee's arguments denying a conflict of interest in this case are noteworthy in two other significant respects. First, its argument that Dr. Souw's work for BMS in the fields of microwave plasmas and CVD analysis "do not <u>necessarily</u> require the use of hydrinos" leaves open the possibility that these fields <u>may</u> in fact involve BMS's use of hydrinos in some capacity. Of course, Applicant may never know due to the Committee's continued refusal to respond to Applicant's reasonable request to fully disclose the extent of Dr. Souw's improper business activities.

Second, the Committee's argument that "Applicant only shows that BMS has done consulting work in two fields in which applicant believes his invention to be applicable" completely disregards the fact that these two fields practiced by BMS and BlackLight reflect a significant technological overlap between the two companies. As previously noted, the Committee also overlooks Dr. Souw's own admission of his "strong background in microwave plasmas generated in a resonance cavity similar to those used by Applicant," which experience also describes his clandestine work for BMS. Further, in criticizing Applicant for what he "<u>only</u> shows," the Committee again unfairly places the burden on Applicant to produce information regarding the scope of Dr. Souw's work for BMS that remains in the Committee's sole possession despite Applicant's repeated requests for that information.

Were it not for the diligence of Applicant in investigating Dr. Souw's questionable business activities, Dr. Souw would have forever kept his work for BMS a secret. Indeed, the Committee was so reluctant to disclose this information after Applicant first uncovered it that the Committee tried to pass off BMS as Dr. Souw's <u>former employer</u> to avoid a conflict. Having now admitted that Dr. Souw continues in his role as lead scientist for BMS while examining BlackLight's applications, it is even more critical that

the Committee stop stonewalling Applicant's information requests seeking the full extent of Dr. Souw's clandestine business activities.

Notwithstanding the Committee's refusal to cooperate, Applicant believes he has gathered sufficient evidence to establish a genuine conflict of interest for all the reasons previously stated. The Committee acknowledges as much by its further strained argument that the conflict can simply be erased because Dr. Souw has the "option of either withdrawing from working on the present application, or refraining from working [for BMS] on the competing subject matter outside of the PTO."[135] The Committee could not be more wrong on this point. Inasmuch as Dr. Souw has already "poisoned the well" with his biased views, it is ridiculous to now suggest that Dr. Souw can somehow inoculate himself from conflict charges by having the mere option of discontinuing his role as lead examiner for the Committee or lead scientist for BMS on the competing subject matter. Applicant has already been severely harmed by a conflict of interest that the Committee has all but admitted, and it is incomprehensible how the Committee's so-called "option" can possibly undo that damage.

Of course, once the Committee comes clean with a full disclosure of all of Dr. Souw's outside business activities, his contacts with outside sources regarding Applicant's technology, and his involvement with any professional organizations, as requested above, other conflicts may also emerge and Applicant anxiously awaits that information.[136] In the meantime, the Committee only adds to the injustice perpetrated against Applicant by maintaining the rejections of record, which have been contaminated by Dr. Souw's biased views. Applicant once again strenuously protests this unfair treatment and demands that the rejections in the present application be withdrawn immediately so that this case can finally be allowed to issue.

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[135] Not surprisingly, the Committee is noticeably silent as to whether Dr. Souw intends to exercise one of those so-called "options"—not that it matters, since the damage caused by Dr. Souw's biased views has already been done and neither option can possibly repair that damage.

[136] As previously noted, Applicant disputes the Committee's suggestion that it is his burden to uncover and produce this vital information. Nonetheless, Applicant is continuing to investigate these matters and will provide additional relevant information concerning Dr. Souw's questionable activities as it becomes available.

Dr. Souw's Biased Views Adopted by the Committee
are Further Demonstrated by Citation to His Own Work

The genuine conflict of interest surrounding the questionable business activities of Dr. Souw is not the only source of bias he brings to this case. Dr. Souw also demonstrates extreme bias by citing two of his own technical papers published in the journal *Physica* to support the rejection of Applicant's claims on theoretical grounds.[137] This procedural miscue is inherently unfair for two obvious reasons.

First, the Committee fails to show that the journals in which Dr. Souw's technical papers appear are any more "scientifically qualified" with the appropriate review process than the journals that published Applicant's papers. Yet the Committee gives Dr. Souw's papers the "credibility that peer-reviewed articles have," while refusing to bestow that same credibility on Applicant's peer-reviewed journal articles. [See, for example, page 5 of the Committee's May 19, 2004 Office Action in U.S. App'n Ser. No. 09/362,693.] The Committee's reliance on Dr. Souw's papers merely illustrates an obvious double standard and demonstrates once again its bias against Applicant in failing to fairly consider his experimental evidence published in prestigious journals as scientifically qualified, which evidence far outweighs the scant evidence produced by Dr. Souw.

When Applicant previously pointed out that this double standard is but another example of the Committee's arbitrary and capricious handling of Applicant's cases, the Committee responded with an even more contorted argument confirming as much:

> Applicant argues (page 126) that many of his cited articles "have in fact passed the peer-review process" (emphasis applicant's). The fact that some may have passed this process does not nullify the fact that others have not. The failure to pass or undergo peer review is only one reason why applicant's evidence is unpersuasive. [See, for example, page 5 of the Committee's November 21, 2005 Office Action in U.S. App'n Ser. No. 09/110,678.]

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[137] Dr. Souw's extreme bias against Applicant is further demonstrated by his many outlandish statements adopted by the Committee, such as his comment equating Applicant's sophisticated hydrogen technology with "crop circles"! [See, e.g., the May 12, 2005 Advisory Action in U.S. App'n Ser. No. 09/669,877.]

This latest argument only further exposes the hypocrisy of the Committee's inconsistent positions. Applicant published his confidential data in peer-reviewed journal articles after the Committee required him to do so. Then, when Applicant pointed out that the Committee improperly discounted this evidence as not having been published in peer-reviewed articles, while attributing enhanced credibility to Dr. Souw's peer-reviewed articles that it relied upon, the Committee responds by arbitrarily rejecting Applicant's published evidence anyway simply because other evidence has not yet been published.[138] Unable to put forward a convincing argument based on that novel evidentiary standard, the Committee arbitrarily concocts yet another one in asserting that the journals that have peer reviewed and published Applicant's scientific evidence are not sufficiently "mainstream" to be given credible weight, a specious argument if there ever was one. [See, e.g., the Committee's September 29, 2005 Office Action at p. 19 filed in U.S. App'n Ser. No. 09/669,877.] Again, the Committee, by advancing such inane arguments, succeeds only in proving Applicant's point that it has denied him a fair and expeditious hearing on his scientific evidence.

The second reason that the Committee's reliance on the views of Dr. Souw based on citation of his own technical papers against Applicant is inherently unfair is because Dr. Souw can no longer be viewed as an impartial judge. How can the Examiner claim to be unbiased in response to arguments criticizing his own technical papers? The answer is obvious: he can't.

In any case, now that the Committee has relied upon Dr. Souw's own scientific research to support its rejections, Applicant is entitled to know from the Committee certain details of the Examiner's background, including a complete disclosure of his technical education and past work experiences. The Committee's steadfast refusal to disclose that relevant information provides a further basis for overturning its rejections.

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[138] As previously noted, despite interference by Dr. Zimmerman—and perhaps by Dr. Park as well—in contacting various journals urging them not to publish Applicant's work, Applicant has been extremely successful in getting his articles published. Since the PTO is relying on the results of the activities of Dr. Zimmerman and/or Dr. Park denying publication of some of Applicant's articles, their involvement and interference in the prosecution of Applicant's pending applications is all the more relevant.

In a previous Office Action, the Committee tried, but failed, to rationalize why Dr. Souw should be allowed to cite without scrutiny his own technical papers against Applicant:

> Applicant note[s] the involvement of Examiner Bernard Souw in the examination of another of his applications, and that Examiner Souw had previously worked for Brookhaven National Labs. Two things are thus pointed out. First, examiners are allowed, and even encouraged, to consult other examiners on matters of science. Dr. Souw is the author of the attached Appendix. While originally written for Serial No. 09/513,768, the Appendix is considered relevant to the present application for reasons stated below. Second, the employment history of examiners, including those acting in a consulting role, is irrelevant to the examination thereof, except where there is a genuine conflict of interest. [See April 14, 2004 Office Action at p. 4 in U.S. App'n. Ser. No. 09/008,947.]

The first point—that the PTO generally encourages consultation with other Examiners—is not even in dispute and is therefore irrelevant. The present objection to the Committee's consultation of Dr. Souw is his obvious bias in citing papers he authored, which requires that he critically analyze and respond to criticisms of his own work.

The Committee's second point—that the employment history of Examiners is only relevant when there is a "genuine conflict of interest"—is a backward standard that defies common sense.[139] As Applicant aptly demonstrated above, it was only after the Committee forced him to conduct an independent investigation into Dr. Souw's relevant employment history, by improperly withholding that information, that Applicant was then able to demonstrate the existence of a genuine conflict in this case. It would have been impossible to demonstrate that conflict had Applicant not first learned of the Examiner's relevant employment history involving his ongoing ownership and operation of BMS. Thus, it comes as no surprise that the Committee would like to keep from Applicant other relevant information that may strengthen his case.

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[139] Applicant disputes that a genuine conflict of interest is actually necessary to show bias—even the appearance of a conflict should be sufficient to taint the views expressed by Dr. Souw. This point is moot, however, since genuine conflicts of interest based on Dr. Souw's outside business activities have been shown, which conflicts have fatally infected Dr. Souw's biased views adopted by the Committee.

In any event, now that Applicant has satisfied the Committee's "genuine conflict of interest" requirement, the Committee is obligated under its own backward standard to disclose the complete nature and scope of Dr. Souw's employment history so that a full determination can be made regarding the existence of other such conflicts.

**Dr. Souw's Biased Views Adopted by the
Committee Are Further Damaged by His
Reliance on the Fraud Perpetuated by Dr. Rathke**

Applicant has cited numerous examples in the preceding pages that demonstrate the extreme hostility exhibited by the Secret Committee and its most prominent member, Examiner/BMS President Souw, raising serious questions concerning the Committee's ability to fairly evaluate Applicant's claimed invention that only weaken its case. The Committee, however, has taken its extremism to a whole new level by adopting the conflicted views of Dr. Souw who now relies on dubious "evidence," including an article written by Dr. Andreas Rathke criticizing Applicant's theory as flawed by fraudulently misrepresenting mathematical equations underlying that theory. [*See, e.g.,* the September 29, 2005 Office Action filed in U.S. App'n Ser. No. 09/669,877, and November 14, 2005 Office Action filed in U.S. App'n Ser. No. 09/813,792.]

As Applicant has pointed out on numerous occasions—without even the slightest acknowledgment from Examiner/BMS President Souw—Dr. Rathke's critique is based on a misrepresentation of Applicant's theory in which he changed mathematical signs in Equations (1) and (9). In so doing, Dr. Rathke effectively fabricated new equations, which he then proceeded to "debunk" in his article. By fraudulently passing off his own debunked equations as Applicant's, Dr. Rathke has exposed himself as nothing more than a typical "mouthpiece" for the APS who totally lacks credibility in the scientific community.

That alone would be cause for great concern. Far more troubling, however, is the complicity demonstrated by the Committee and its conflicted lead Examiner, BMS President Souw, in placing its stamp of approval on the fraud perpetuated by Dr. Rathke in his article. Despite Applicant's repeated warnings against taking that extreme position, the Committee has refused to heed those warnings. [*See, e.g.,* the

Committee's September 29, 2005 Office Action filed in U.S. App'n Ser. No. 09/669,877

("Andreas Rathke of the <u>European Space Agency</u> (ESA) has published an article

entitled "A critical analysis of the hydrino model" in the <u>New Journal of Physics</u> (vol. 7

(2005) 127) and the article *reaches the same conclusion* as set forth by the examiner

that the applicant's CQM is mathematically and scientifically flawed and does not predict

the existence of hydrino states.") (Emphasis added.)]

Indeed, after being advised of Dr. Rathke's fraudulent analysis, Dr. Souw has not

only refused to disavow it, but rather, has embraced that analysis even more vigorously,

essentially adopting it as his own:

> A. Rathke, *"A critical analysis of the hydrino model"*, New Journal of
> Physics, Vo.7 (2005) page 127, prov[es] that Applicant's electron wave
> function ρ in the form of δ function (Rathke's Eq.5-7) is not at all a solution
> of the corresponding wave equation (Rathke's Eq.1). **Rathke's result is
> essentially the same as the Examiner's Appendix** (towards the end of
> section 4), reciting *"rigorously performing all mathematical operations, it
> comes out that Applicant's wave function p(r,t) is NOT at all a solution of
> Eq. 1.1 as claimed by Applicant throughout his hydrino hypothesis. That
> Applicant's p(r,t) is neither a solution of the Schrodinger equation is too
> obvious, since it does not contain the electron mass".* [November 14,
> 2005 Office Action filed in U.S. App'n Ser. No. 09/813,792 at 12
> (emphasis added).]

By admitting that the results conveyed in Dr. Souw's Appendix is "essentially the

same" as the fraudulent results discussed in Dr. Rathke's article, the Committee has

discredited the entire basis for its own rejections in this case. The Committee's

continued citation and reliance on that article merely perpetuates the fraud that Dr.

Rathke initiated against Applicant and stands as a monumental embarrassment to the

PTO.

Applicant further finds it incomprehensible that Applicant has had to publish his

experimental evidence in peer-reviewed journal articles to be considered credible and to

show acceptance by the scientific community, only to have the Committee ignore that

evidence; yet the Committee is quick to rely on Dr. Rathke's fraudulent article and the

biased views of Examiner/BMS President Souw, which so-called "evidence" no

reputable member of the scientific community would accept.

In light of the awkward position the Committee now finds itself, Applicant

requests that it immediately suspend Dr. Souw from any further examination of this and all other BlackLight applications and that all rejections of record in these cases, which have been tainted by Dr. Rathke's fraudulent analysis, be withdrawn immediately so that Applicant's patents may be allowed to issue.

Should the Committee refuse to honor these requests despite the close correspondence between the Committee's analysis of Applicant's theory and Dr. Rathke's fraudulent analysis, Applicant further requests that the Committee provide any and all information relating to: (1) communications between the PTO and either Dr. Rathke or other persons with regard to Dr. Rathke or his fraudulent analysis of Applicant's theory; and (2) activities or other involvement by Dr. Rathke or others that led the Committee to adopt Dr. Rathke's fraudulent analysis.

Further Confirmation of the Committee's "Allowance is Not an Option"
Policy and Its Refusal to Grant Applicant a Fair and Expeditious Hearing

Examiner Wayner Confirmed the Committee's
Official Policy Not to Allow Applicant's Cases

As discussed above, Examiner Langel initially advised Applicant that a Committee of PTO officials he could not identify was responsible for authoring the Office Actions he was instructed to sign as the named Examiner of record in the cases assigned to him. Examiner Kalafut later confirmed that he was also merely the named Examiner of record and that he too did not author the Office Actions issued by the Committee in his cases. Given that these two senior PTO employees, having over 50 years of experience between them, were being used as Examiners-in-name-only by this "Secret Committee," Applicant found it odd that another named Examiner, William Wayner, would make the following statement in another BlackLight application to which he was assigned:

> For the record this Examiner makes it clear that there is no committee in charge of this application, that all of the office actions in this case have been done by me alone an[d] that I have never been told that I could not allow this application. [See April 26, 2004 Office Action issued in U.S. App'n Ser. No. 09/181,180 ('180 application).]

Applicant's initial doubt regarding the veracity of that statement was confirmed in an initial telephone conversation held on October 5, 2004, between Applicant's counsel, Jeffrey A. Simenauer, and Mr. Wayner, following his retirement from the PTO as an Examiner, and in a follow-up telephone conversation held on October 25, 2004.

Sometime in mid-September, Mr. Wayner had called and left Mr. Simenauer, a former PTO colleague, a telephone message informing him of his retirement and his desire to secure patent search work to do in his spare time. Mr. Simenauer returned Mr. Wayner's call and spoke to him on October 5th about doing some possible work, after which the conversation turned to Mr. Wayner's involvement in the examination of the '180 application. The substance of that conversation was confirmed in an e-mail Mr. Simenauer sent to Mr. Wayner on October 15, 2004. [See Attachment S.]

During the October 5 phone conversation, Mr. Wayner was very candid in complimenting Dr. Mills for the way he had handled himself during the February 11, 2003 Interview, commenting that "Mills is one hell of a persuasive man" and that "he came across as very convincing" at the Interview. In his October 15 e-mail, Mr. Simenauer thanked Mr. Wayner for those comments, which he indicated had been forwarded to Dr. Mills.

Mr. Simenauer then told Mr. Wayner that, while he disagreed with the positions Mr. Wayner had expressed during the Interview, including his skepticism regarding the operability of Mills' invention, he still respected those views. Mr. Simenauer, however, made clear to Mr. Wayner that what really upset him were the questionable actions that the PTO has taken against BlackLight prejudicing its patent rights. In that regard, Mr. Simenauer recalled Examiner Langel's resignation from examining Applicant's cases "for moral and ethical reasons" due to instructions he had been given to misrepresent the record to promote the PTO's "allowance is not an option" policy. Specifically, Mr. Simenauer reminded Mr. Wayner of how Examiner Langel was told to say that he was against allowing Dr. Mills' applications, when in fact he favored doing so, and that he had authority to issue Dr. Mills his patents, when he clearly had no such authority.

Mr. Wayner confirmed this official position of the Patent Office "not to allow [Dr. Mills'] cases" and admitted that he could not tell Mr. Simenauer this while he was still

working at the PTO. As stated in his October 15 e-mail, Mr. Simenauer appreciated Mr. Wayner's honesty and understood why he had previously remained silent.

As further stated in his e-mail, Mr. Simenauer had first decided not to ask Mr. Wayner to go "on the record" with this information, given that Applicant already had a record of Examiner Langel's statements that the PTO had in place an "allowance is not an option" policy and that he was asked to misrepresent his authority to issue patents in BlackLight's cases. Mr. Simenauer mentioned, however, that a problem had arisen that had caused him to reconsider that decision. Mr. Simenauer explained that his review of Mr. Wayner's last Office Action in the '180 application had turned up the above-quoted statement that "I [Wayner] have never been told that I could not allow this application," which contradicted what Mr. Wayner had told Mr. Simenauer previously on the phone regarding his lack of authority to allow it.

In view of Examiner Langel's admission that he was told by senior PTO officials that he did not have authority to allow BlackLight's applications under any circumstances, but that he should give the false impression that he did have such authority, Mr. Simenauer expressed concern in his October 15 e-mail that the PTO might have put Mr. Wayner in a similar uncomfortable position when he stated that he had authority to allow the '180 application. Mr. Simenauer then informed Mr. Wayner that, as BlackLight's patent counsel, he was obligated to press the matter. Knowing Mr. Wayner to be "a man of utmost integrity," Mr. Simenauer further stated that he felt comfortable requesting "[his] assistance in simply uncovering the true facts regarding the PTO's policy decisions that have been made against BlackLight."

In response to Mr. Simenauer's e-mail, Mr. Wayner called him on October 25, 2004 and left a message, which call was then returned the same day by Mr. Simenauer and the undersigned co-counsel, Jeffrey S. Melcher. At no time during this subsequent telephone conversation did Mr. Wayner deny the substance of his earlier October 5th conversation with Mr. Simenauer as reflected in the October 15th e-mail. Rather, Mr. Wayner started the conversation by stating, "You should know better. I don't want to get involved in this anymore." Mr. Wayner further stated that he did not want to talk any further about the subjects discussed in Mr. Simenauer's confirmation e-mail and that, in his words, "you will have to go by what's on the record," making clear to Applicant's

counsel that he would not accept their request for assistance regarding the truth of his statements in the present Office Action.

Mr. Wayner also stated that while he wanted to continue his personal friendship with Mr. Simenauer, he also wanted "to stay out of the [BlackLight] case." Mr. Simenauer apologized for troubling him with this matter and informed Mr. Wayner that he may not be able to remain out of the BlackLight case against the PTO if it were to go to trial following an appeal to the PTO Board. Somewhat nervously, Wayner responded by stating that "it is a very dangerous situation" for him, and again made clear that he did not want to talk about it any further. Mr. Simenauer told Mr. Wayner that he understood and sympathized with his situation and that he did not want to put him in the uncomfortable position of having to say anything more on the subject.

Mr. Wayner then stated that he had changed his mind about seeking search work from Mr. Simenauer as he had initially requested since, in his words, "I don't want it to look like a *quid pro quo*." Again, Mr. Simenauer expressed his understanding of the situation Mr. Wayner found himself in and that ended the conversation.

In light of these unfortunate developments, Applicant must demand that the PTO Committee cease and desist from any further attempts to cloud the administrative record in his cases so as to make it appear that the "Examiners-in-name-only" are solely responsible for its actions. As with the situation involving instructions that led to Examiner Langel's resignation "for moral and ethical reasons," Applicant further demands that the Committee provide a complete account of the facts and circumstances that led to the questionable statements appearing in the Office Action signed by Examiner Wayner in the '180 application prior to his retirement.

Examiner Tsang-Foster Has Confirmed the Committee's Refusal to Fairly Evaluate Applicant's Scientific Evidence

The Committee's "allowance is not an option" policy has been further advanced by yet another Examiner, Susy N. Tsang-Foster.[140] Examiner Tsang-Foster basically

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[140] Examiner Tsang-Foster's name and signature appear at the end of Office Actions in certain BlackLight applications. Like other Examiners, whose names have appeared in various BlackLight cases, but have admitted not being responsible for the content of the Committee's Office Actions, Examiner Tsang-Foster is also believed to be merely an Examiner-in-name-only.

admits to the Committee's continued refusal to grant Applicant a fair hearing on the mountain of scientific evidence, <u>submitted at its request</u>, proving the existence of lower energy states of hydrogen. [See, for example, the May 12, 2005 Advisory Action issued in U.S. App'n Ser. No. 09/669,877.][141]

With now over <u>65</u> peer-reviewed articles published in respected scientific journals—and the list keeps growing—Applicant has achieved acceptance in the scientific community, which was <u>improperly</u> required by the Committee as a condition for patentability in this case. Rather than fully and fairly evaluate Applicant's compelling experimental evidence, the Committee now takes the extreme position that all of this evidence "<u>detract</u>[s] from the central issue that the hydrino does not theoretically exist." [See May 12, 2005 Advisory Action in U.S. App'n Ser. No. 09/669,877 at page 2 (emphasis added).] Out of the multitude of baseless arguments contrived by the Committee, this one truly stands out as perhaps the most outrageous.

Applicant has spent enormous amounts of effort and money complying with the PTO's arbitrary requirement that he publicly disclose his confidential data in peer-reviewed publications to prove the existence of lower-energy hydrogen. Now, incredibly, Applicant is being told that those efforts have been for naught since, according to the Committee, "all of applicant's data cannot prove what is not theoretically possible." [See May 12, 2005 Advisory Action in U.S. App'n Ser. No. 09/669,877 at page 2.] This statement is not only grossly erroneous, but it also contradicts the Committee's own prior statements. Indeed, in previous Office Actions, the Committee has responded to Applicant's criticism by vehemently denying that it was taking the position that the existence of lower-energy hydrogen was impossible. For

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[141] The Committee created another procedural morass in that case when it issued the May 12, 2005 Advisory Action, which required Applicant's response to forty-four pages of new arguments and twenty-one newly cited references. It was bad enough that the Committee included these voluminous new arguments in an Advisory Action without extending Applicant the courtesy of withdrawing the finality of the April 22, 2004 Office Action and establishing a new time period for him to respond. The Committee only made the situation more onerous by mailing its Advisory Action on May 12, 2005, almost <u>seven months</u> after Applicant had responded to that Final Office Action on October 22, 2004, leaving Applicant <u>less than ten days</u> to respond.

Applicant attempted to correct this latest abuse of PTO procedures—effectively denying him a fair hearing—by requesting that a new time period be set. That request was initially ignored and then later denied without a satisfactory explanation.

instance, Committee-member Souw tried to claim:

> Contrary to Applicant's allegation on pg. 13, 1st full paragraph, lines 2-4, <u>the PTO's view is not at all that the existence of lower-energy hydrogen were impossible</u>, but instead, that (a) Applicant's invention is not supported by any experimental fact or evidence, and (b) the underlying theory (i.e., GUT/CQM) fails to support the invention, because it contains too many flaws. [Souw Appendix at p. 3 attached to the Committee's Final Office Action mailed August 24, 2004 in Applicant's U.S. Ser. No. 08/467,051 (emphasis added).]

Such inconsistent positions permeate all of the Committee's Office Actions and provide further grounds for overturning the pending rejections.

As Applicant has consistently argued, the only way to settle the theoretical argument on whether lower-energy hydrogen actually exists is to properly evaluate the real-world evidence that Applicant and independent third parties have generated. For the Committee to now assert that this real-world evidence "detract[s] from the central issue that the hydrino does not theoretically exist" turns science on its head and is an embarrassment to a government agency charged with "promot[ing] the Progress of Science and useful Arts." [*See* U.S. Constitution, Art. I, Sect. 8, Clause 8.]

Summary

In sum, Applicant is completely mystified by the Secret Committee's arbitrary and often hostile approach that so far has denied him a fair and expeditious examination of his applications in confirmation of the "allowance is not an option" policy divulged by former Examiners of Applicant's cases. There is simply no other way to describe the Committee's reliance on tainted "evidence" (*e.g.*, Dr. Rathke's fraudulent article) and other questionable analyses that lower-energy hydrogen cannot exist under a haphazard framework that lacks proper legal support and instead relies on a patchwork of contrived vague and double standards—and often no standards at all. Even when Applicant meets these so-called "standards," such as those requiring him to publish his scientific evidence in peer-reviewed journals to be considered credible and to show acceptance of his technolodgy by the scientific community, the Committee simply introduces new "standards" as a further excuse to dismiss that evidence. So now,

before any of Applicant's experimental evidence can be fully considered, all of it must successfully complete the peer-review process, but only if it is published in journals that the Committee deems to be sufficiently "mainstream." And even then, the Committee still can and does ignore Applicant's evidence under the extreme view that it supposedly detracts from what the Committee considers to be the central issue in this case, *i.e.,* that the existence of lower-energy hydrogen is supposedly theoretically impossible and, therefore, is considered "incredible."

In Applicant's view, it would be far easier to nail jelly to the wall than to meet the Committee's arbitrary and capricious patentability requirements for enablement and utility. Applicant has had over $50 million of private investment in the research being conducted at BlackLight Power's 53,000-square-foot facility, resulting in the publication of over 65 peer-reviewed articles in esteemed scientific journals citing evidence of lower-energy hydrogen. The Committee's rejection of that considerable body of work based on arguments and "standards" that exalt fraudulent articles and other blatant misrepresentations over real-world evidence is an insult not just to this one applicant, but to the entire patent community which puts its trust in the U.S. Patent and Trademark Office to fairly administer the laws and regulations governing the examination process.

The Committee's continued hostile approach to examination of Applicant's patent applications led by an Examiner (BMS President Souw) whose views are clearly clouded by competing outside business interests, and its refusal to fairly consider Applicant's experimental evidence published in over 65 peer-reviewed articles, is perhaps best explained in the March 10, 2006 edition of the *Financial Times*:

> Psychologists call it **cognitive dissonance: the mental torment that comes from being confronted by two fundamentally opposed propositions**. Deciding between them often provokes powerful emotions – just ask Dr Randell Mills, whose claims have a habit of triggering severe bouts of cognitive dissonance among otherwise perfectly rational people.
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> * * *
>
> **Faced with making up their minds, many scientists have shown the classic symptom of cognitive dissonance: spluttering rage** (it is a safe bet that some are even now tapping out letters of complaint to this newspaper). **They simply refuse point-blank to believe that Dr Mills**

could have found a form of atomic energy missed by the likes of Albert Einstein and Ernest Rutherford.

* * *

Not that Dr Mills cares about what mainstream scientists think about his - theory: he is too busy extracting ever more insights from it – most recently, **formulas describing the properties of molecules, something that has proved beyond the powers of quantum mechanics . . . .** [Emphasis added (Attachment T).]

The views of the Committee, expressed most prominently by Examiner/BMS President Souw, in refusing to fairly consider Applicant's evidence in favor of adopting fraudulent "evidence" is simply outrageous and displays all the signs of cognitive dissonance reported by the *Financial Times*. Applicant therefore repeats his prior demands that the present rejections be withdrawn and that Dr. Souw be replaced immediately so that the experimental evidence of record can finally be given the fair and expeditious hearing Applicant deserves, whereupon his patents can then begin issuing once again.

Demand for Information and Redress

Applicant believes that the totality of events documented above are highly relevant to the PTO's examination of all of BlackLight's patent applications and accurately describe the detrimental effects that examination has had on Applicant's patent rights. These events further demonstrate the PTO's failure to provide adequate safeguards to the interests of Applicant, including fair and expeditious examination, as contemplated by the Federal Circuit in its June 28, 2002 Decision. Applicant therefore respectfully demands that the PTO provide certain information and redress, including:

1) identification of all Examiners or other PTO personnel who were consulted, or otherwise provided input, in the examination of BlackLight's applications;

2) identification of all other persons from outside the PTO who were consulted, or otherwise provided input, in the examination of BlackLight's applications;

3) identification of all PTO officials responsible for withdrawing BlackLight's five allowed applications from issuance and a complete disclosure of the facts and circumstances surrounding that withdrawal action;

4) identification of all outside sources of information who may have precipitated, or otherwise contributed to, the PTO withdrawing BlackLight's five allowed applications from issuance and a complete disclosure of the facts and circumstances surrounding those actions;

5) a complete disclosure of the facts and circumstances surrounding the removal of Examiner Langel from examining BlackLight's applications and the transfer of those cases to a new Examiner, including, but not limited to, identification of all persons involved in those actions;

6) the information sought above in connection with the questionable statements made by Examiner Wayner in the '180 application;

7) the information sought above in connection with (a) Dr. Souw's conflict of interest in owning and operating BMS Enterprise while assigned by the PTO to examine BlackLight's pending patent applications; and (b) Dr. Souw's reliance on the fraudulent article written by Dr. Adreas Rathke to reject those applications;

8) the immediate removal of Examiner/BMS President Souw, and other members of the Secret Committee, from examining all pending BlackLight applications, and the reinstatement of Examiner Langel to his position as the Examiner of record in those cases to which he had been previously assigned;

9) the examination and issuance of all allowable BlackLight applications in accordance with the above-mentioned representations and agreements made at the February 11, 2003 Interview; and

10) as a matter of equity, the immediate issuance, without further examination, of all five of BlackLight's withdrawn patent applications due to the PTO's failure to provide the safeguards to the interests of Applicant, including fair and expeditious further examination, as contemplated by the Federal Circuit in its June 28, 2002 Decision.

Response to Arguments Raised in the Final Office Action Mailed May 9, 2006

Applicant reached agreements with the PTO during the February 11, 2003 Interview as to how it would conduct its examination of BlackLight's applications following the tumultuous prosecution history of these cases. The Secret Committee, in its subsequent Office Actions, including the present one, has defaulted on those agreements, whereby examination in this case has reverted back to ignoring most of Applicant's scientific evidence on baseless theoretical grounds without applying reasonable patent standards in furtherance of its "allowance is not an option" policy. Despite the unfairness of these actions, Applicant will not be deterred from seeking the patent rights to which he is entitled.

With that said, Applicant now addresses and defeats the Committee's arguments presented in its latest Office Action, which primarily rely upon the biased and erroneous views of its lead Examiner, Dr. Bernard Eng-Kie Souw, including those found in the numerous Appendices he authored.[142] Applicant has rebutted each and every point raised in this Office Action and explains why each lacks merit. As previously discussed, the Committee's adoption of Dr. Souw's views to reject the claims in this case is also misguided due to his genuine conflict of interest in working as the lead scientist for a competing company (BMS Enterprise) while examining Applicant's cases and in citing his own technical papers against Applicant.

For these many reasons, the Committee's biased and erroneous rejections are simply not credible and do not stand up to Applicant's overwhelming experimental evidence of lower-energy hydrogen that the Committee has either misconstrued or dismissed altogether on highly questionable grounds. In doing so, the Committee has once again turned its back on an agreed upon standard, this time involving its self-imposed requirement that Applicant publish his experimental data supporting the existence of lower-energy hydrogen in peer-reviewed scientific journals. Applicant

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[142] Applicant further includes as part of this Response his rebuttal to Dr. Souw's Consolidated Appendix, which includes many of the same erroneous arguments found in the present Office Action.

protests these arbitrary actions in the strongest terms possible and requests that the Committee reconsider its tenuous position and immediately allow this case to issue.[143]

Despite the fact that the Committee has never cited any authority to support its publication requirement, Applicant expended considerable effort—not to mention millions of research dollars—complying with it. Yet, now that Applicant has published his experimental data in over 65 technical papers appearing in a number of respected scientific journals, with another 50-plus papers soon to follow, Applicant is advised that those efforts were for naught.

The arguments contained in Committee's present Office Action are astonishing for many other reasons, but mostly for the level of hostility directed at Applicant. The Committee cites no legitimate scientific evidence against Applicant to counter the voluminous real-world evidence he submitted in his peer-reviewed journal articles establishing the existence of lower-energy hydrogen. Rather, the Committee relies on the conflicted views of its lead Examiner/BMS President Souw, and on dubious articles, such as the one authored by Dr. Andreas Rathke, who criticizes Applicant's theory as flawed by fraudulently misrepresenting his mathematical equations. The Committee applies this and other fictitious "evidence" in an effort to elevate to a physical law what amounts to an outdated theory of quantum mechanics that is itself fatally flawed to make it seem as though Applicant's claimed technology is "incredible." Even the conflicted Dr. Souw has recognized that quantum theory is flawed, *i.e.*, "needs improvement," and that the existence of lower-energy hydrogen is not impossible. [See *supra*.]

Turning now to the Committee's specific arguments, the Committee contends on page 4 of the Final Office Action that "1) Attachments 94, 102, 108, 109 and 111-114 fall into category (1) a set forth in paper no. 36, i.e. they have not been peer-reviewed." Applicant finds somewhat amusing Dr. Souw's statement in his Appendix that

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[143] To fully comprehend the unfairness of the Committee's dismissal of Applicant's scientific data, it should first be noted that it was the Committee that required Applicant, over his strenuous objections, to publish that data in peer-reviewed scientific journals. This requirement stemmed from an Interview held on February 21, 2001, during which Examiner Vasudevan Jagannathan refused to take seriously the data presented at the Interview because it had not been subjected to the peer-review process required by most scientific journals prior to publication. For instance, as discussed above, Examiner Jagannathan mischaracterized Applicant's highly reliable spectroscopic data as nothing more than a "bunch of squiggly lines."

"[b]ecause of their fundamental flaws, [these articles] are not likely to pass the peer review process." [See Souw Appendix.] Given that 65 of Applicant's articles relating to lower-energy hydrogen have passed the peer-reviewed process, they do "have the credibility that peer reviewed articles have," and this application is in condition for allowance according to the Committee's own strained standards.

On page 4 of the Office Action, the Committee argues that "2) Attachments 94, 108, 111 and 112 fall into category (3), because they contain data not accounted for by applicant's theory, as explained in paper no. 33, pages 3 and 4." Reference 94 discloses the isolation of fraction-principal-quantum-level molecular hydrogen $H_2(1/p)$ gas by liquefaction using an ultrahigh-vacuum, liquid nitrogen cryotrap, and the observations of novel peaks by cryogenic gas chromatography, a higher ionization energy than H_2 by mass spectroscopy, a substantial change in the EUV emission spectrum with deuterium substitution in a region where no hydrogen emission has ever been observed, and upfield shifted NMR peaks at 0.21, 2.18 and 3.47 ppm compared to that of H_2 at 4.63 ppm. Reference 108 discloses the identification of novel hydride compounds by a number of analytical methods, such as (i) time of flight secondary ion mass spectroscopy which showed a dominant hydride ion in the negative ion spectrum, (ii) X-ray photoelectron spectroscopy which showed novel hydride peaks and significant shifts of the core levels of the primary elements bound to the novel hydride ions, (iii) ^1H nuclear magnetic resonance spectroscopy (NMR) which showed extraordinary upfield chemical shifts compared to the NMR of the corresponding ordinary hydrides, and (iv) thermal decomposition with analysis by gas chromatography, and mass spectroscopy which identified the compounds as hydrides. Reference 111 relates to the observation of an energy balance of $\Delta H = -17,925 \ kcal / mole \ KNO_3$, about 300 times that expected for the most energetic known chemistry of KNO_3, and $-3585 \ kcal / mole \ H_2$, over 60 times the hypothetical maximum enthalpy of $-57.8 \ kcal / mole \ H_2$ due to combustion of hydrogen with atmospheric oxygen, assuming the maximum possible H_2 inventory when KNO_3 and Raney nickel were used as a source of K catalyst and atomic hydrogen, respectively, to produce the corresponding exothermic reaction. Reference 112 discloses the observation of energy balances of helium-hydrogen microwave plasmas of over 100 times the combustion of hydrogen and power densities greater than $10 \ W / cm^3$ measured by

water bath calorimetry. Thus, these references clearly relate to and, thus, support the formation of Applicant's predicted lower-energy states of hydrogen and the Committee's failure to recognize this fact only further confirms its refusal to give Applicant's data serious consideration. Applicant's response to the Appendix filed on March 8, 2006 provides further arguments, which the Committee simply ignores.

On page 4 of the Final Office Action, the Committee argues that "3) Attachments 58, 88, 102, 108-110, 113 and 114 fall into category (4), because they speculate hydrino formation as an explanation for experimental data unrelated to, and not necessarily caused by hydrinos, such as Balmer line broadening, calorimetric data, or 'indications' of hydride chemical bonding." The Committee again provides no support for this mere conclusion. As discussed above, the data in these references clearly supports the formation of Applicant's lower-energy hydrogen. Reference 88 discloses the observation that microwave helium-hydrogen and argon-hydrogen plasmas having catalyst Ar^+ or He^+ showed extraordinary Balmer α line broadening due to hydrogen catalysis corresponding to an average hydrogen atom temperature of $110 - 130\ eV$ and $180 - 210\ eV$, respectively; whereas, plasmas of pure hydrogen, neon-hydrogen, krypton-hydrogen, and xenon-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of $\approx 3\ eV$. References 108 and 110 disclose the identification of novel hydride compounds by a number of analytical methods, such as (i) time of flight secondary ion mass spectroscopy which showed a dominant hydride ion in the negative ion spectrum, (ii) X-ray photoelectron spectroscopy which showed novel hydride peaks and significant shifts of the core levels of the primary elements bound to the novel hydride ions, (iii) ^1H nuclear magnetic resonance spectroscopy (NMR) which showed extraordinary upfield chemical shifts compared to the NMR of the corresponding ordinary hydrides, and (iv) thermal decomposition with analysis by gas chromatography, and mass spectroscopy which identified the compounds as hydrides. Reference 109 discloses that the formation of a chemically generated hydrogen plasma with the observation of Lyman series in the EUV that represents an energy release about 10 times that of hydrogen combustion, which is greater than that of any possible known chemical reaction. Reference 113 discloses solutions to the atom and photon that match experimental data, confirming the accuracy of Applicant's modern theory. References 58,

102 and 114 disclose experimental data confirming the existence of lower-energy hydrogen. Thus, these references clearly relate to and support the formation of Applicant's predicted lower-energy states of hydrogen and the Committee's failure to recognize this fact only further confirms its refusal to give Applicant's data serious consideration. Applicant's response to the Appendix filed on March 8, 2006 provides further arguments, which the Committee simply ignores.

On page 4 of the Office Action, the Committee states that no copy of reference No. 60 could be found. Applicant submits that a copy of reference No. 60 was submitted with his previous response. For the Committee's convenience, however, Applicant submits herewith another copy of reference No. 60.

On page 3 of the Office Action, the Committee further asserts that:

> Applicant argues (page 22) that the "Committee" has failed to identify "even a single physical law that was supposedly being violated" (emphasis applicant's). As stated on page 15 of the Appendix to the Office action of paper no. 36, applicant's theory violates the **rule** that only intertial (i.e., non-accelerated) frames of reference may undergo Lorenz contraction. [Emphasis added.]

Once again, the Committee is unable to provide support for its misguided rejection of Applicant's novel hydrogen technology. When Applicant had previously forced the Committee to identify a physical law supposedly violated by that technology, it argued, without basis, that the "ground state of an electron of a hydrogen atom" was just such a law. Apparently realizing the fallaciousness of that argument, the Committee has now dropped that argument. The Committee's latest attempt to elevate a mere "rule" regarding frames of reference to the status of an absolute physical law is no more convincing.

The Committee is now in the embarrassing position of dismissing Applicant's real-world scientific evidence demonstrating that the hydrogen atom can be made stable below the ground state, because to accomplish that feat would supposedly violate a "rule" that does not reflect reality. Such circular reasoning does not reflect well on a governmental agency charged with promoting the progress of science and the useful arts. If complying with physical laws is indeed the standard the Committee is applying, then surely it must condemn SQM with all of its anomalies that have no basis in reality

and embrace Applicant's CQM, which is premised in compliance with physical laws, even at the atomic level. The Committee's failure to address this inherent contradiction, which undercuts the entire basis for its pending rejections in this case, is not surprising given its arbitrary refusal to grant Applicant a patent under any circumstances.

The Committee's assertion that Applicant's novel technology based on lower energy states of hydrogen violates physical law and thus can't possibly work further contradicts the express position taken by its lead Examiner, Dr. Souw. When Applicant previously criticized the Committee for its failure to fairly consider Applicant's scientific evidence on the basis that the existence of lower-energy hydrogen was impossible, Dr. Souw took exception to that criticism claiming that "[t]he PTO's view is not at all that the existence of lower-energy hydrogen were [sic] impossible." [See, for instance, Dr. Souw's Appendix at p. 3 attached to the Committee's August 24, 2004 Office Action filed in Applicant's U.S. App'n Ser. No. 08/467,051.] Clearly then, if Dr. Souw does not consider the existence of lower-energy hydrogen impossible, such lower energy states cannot be in violation of any physical law. In now taking a contrary position, the Committee has unwittingly undermined the credibility of Dr. Souw and calls into question other views expressed by him.

In Applicant's modern theory, the electron orbit obeys special relativity. The bound electron must be relativistically corrected. There cannot be rectilinear motion only for a bound electron. The solution that matches a vast collection of data is given in:

113. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", New Journal of Physics, submitted.

and in Applicant's GUT [R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*; May, 2005 Edition, posted at

http://www.blacklightpower.com/theory/bookdownload.shtml].

From Applicant's paper 113:

a. Special Relativistic Correction to the Electron Radius for Motion on a Great Circle

The electron moves in an orbit relative to the laboratory frame. Muons and electrons are both leptons. Time dilation of muonic decay due to relativistic motion in a cyclotron orbit relative to a stationary laboratory frame provides strong confirmation of special relativity and confirms that the electron's frame is an inertial frame. eB/m bunching of electrons in a gyrotron [22] occurs because the cyclotron frequency is inversely proportional to the relativistic electron mass. This further demonstrates that the electron frame is an inertial frame and that electron mass and time dilation occur. The special relativistic relationship in polar coordinates is derived. The result of the treatment of the electron motion relative to the laboratory frame is in excellent agreement with numerous experimental observables such as the electron g factor, the invariance of the electron magnetic moment of μ_B and angular momentum of $\hbar$, the Lamb shift, the fine structure and hyperfine structure of the hydrogen atom, the hyperfine structure intervals of positronium and muonium and the relativistically corrected ionization energies of one and two electron atoms given previously [3, 5-6], *infra.*, and in the Chp. 1 (Determination of Orbitsphere Radii, Energy Calculations, Special Relativistic Correction to the Ionization Energies sections), Chp. 2 (Excited States of the One-Electron Atom (Quantization)) and Chp. 7 (The Two-Electron Atom) of Ref. [7].

The relationship between the electron wavelength and its radius is given by Eq. (6) where λ is the de Broglie wavelength. For each current density element of the spin function, the distance along each great circle in the direction of instantaneous motion undergoes length contraction and time dilation. Using a phase matching condition, the wavelengths of the electron and laboratory inertial frames are equated, and the corrected radius is given by

$$r_n = r_n' \left[\sqrt{1 - \left(\frac{v}{c}\right)^2} \sin\left[\frac{\pi}{2}\left(1 - \left(\frac{v}{c}\right)^2\right)^{3/2}\right] + \frac{1}{2\pi}\cos\left[\frac{\pi}{2}\left(1 - \left(\frac{v}{c}\right)^2\right)^{3/2}\right] \right] \tag{32}$$

where the electron velocity is given by Eq. (13). (See Ref. [7] Chp. 1, Special Relativistic Correction to the Ionization Energies section). $\frac{e}{m_e}$ of the electron, the electron angular momentum of $\hbar$, and μ_B are invariant, but the mass and charge densities increase in the laboratory frame due to the relativistically contracted electron radius. As $v \to c$, $r/r' \to \frac{1}{2\pi}$ and $r = \lambda$ as shown in Figure 15.

Figure 15. The normalized radius as a function of the velocity due to relativistic contraction.
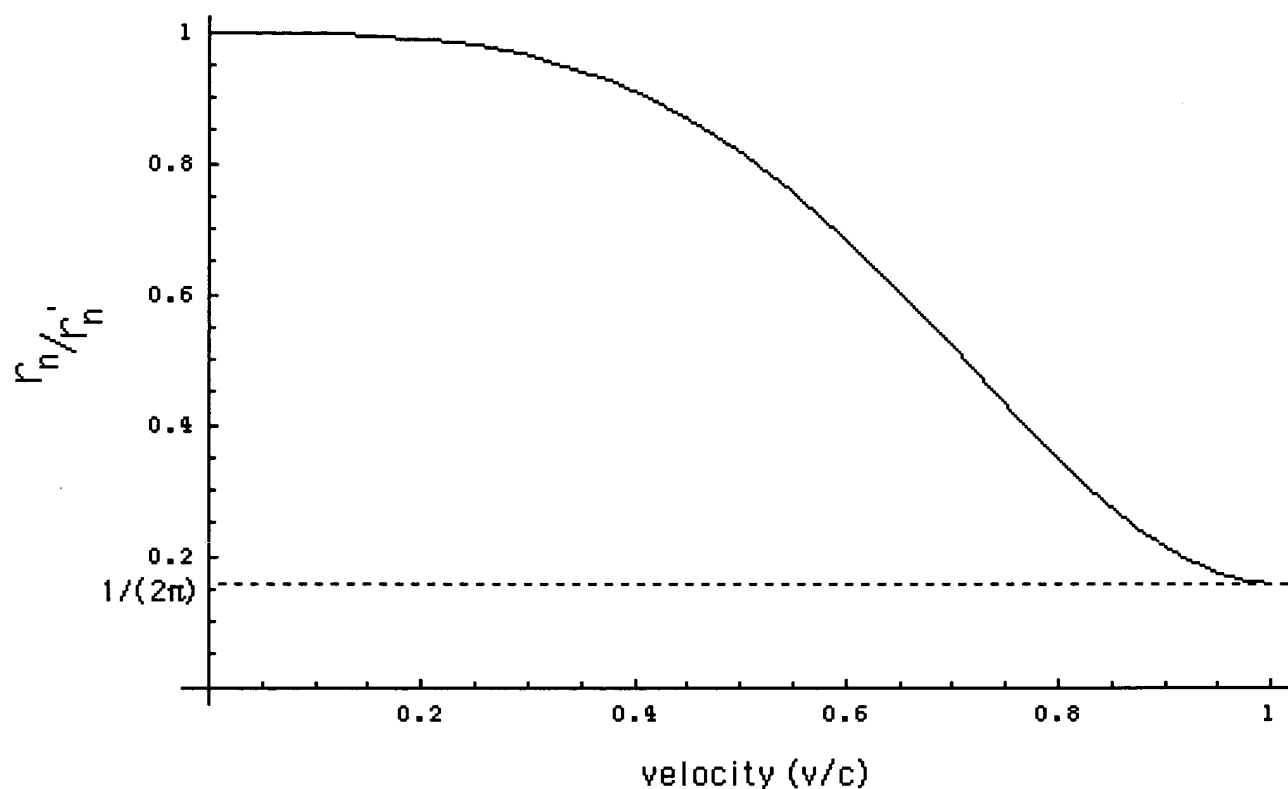
Experimentally, special relativistic effects are observed for nonlinear systems. The electron moves in an orbit relative to the laboratory frame. Muons and electrons are both leptons. Time dilation of muonic decay due to relativistic motion in a cyclotron orbit relative to a stationary laboratory frame provides strong confirmation of special relativity and confirms that the electron's frame is an inertial frame. eB/m bunching of electrons in a gyrotron [P. Sprangle and A. T. Drobot, "The linear and self-consistent nonlinear theory of the electron cyclotron maser instability", IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-25, No. 6, June, (1977), pp. 528-544] occurs because the cyclotron frequency is inversely proportional to the relativistic electron mass. This further demonstrates that the electron frame is an inertial frame and that electron mass and time dilation occur. The

special relativistic relationship in polar coordinates is derived. The result of the treatment of the electron motion relative to the laboratory frame is in excellent agreement with numerous experimental observables such as the electron g factor, the invariance of the electron magnetic moment of μ_B and angular momentum of $\hbar$, the fine structure of the hydrogen atom, and the relativistically corrected ionization energies of one and two electron atoms given in

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty- Electron Atoms", Physics Essays, in press.

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

and in the Excited States of the One-Electron Atom (Quantization) and The Two-Electron Atom sections of Mills GUT.

Applicant's theory is the most successful to date at applying special relativity to the atom as shown in section #55 of the March 2005 Response and Chps 1, 2, and 21 of Mills GUT. SQM can not match these results and is incompatible with special relativity as shown in

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

Thus, Applicant has shown that Krieg's analysis on which the Committee relies is fundamentally flawed and provides no basis for its erroneous conclusion that the ground state of n=1 is a physical law that cannot be violated. It comes as no surprise that this faulty analysis cited by the Committee appears in a web page. What is surprising, however, is that the Committee would place so much weight on what amounts to

nothing more than internet chatter, yet dismisses out of hand Applicant's real-world scientific evidence appearing in over 60 peer-reviewed articles based on the false assumption that what was believed to be the ground state of hydrogen is a physical law that cannot be violated. In fact, it's shocking, and the time has come for the Committee to grant Applicant the fair and expeditious hearing on his evidence to which he is entitled.

On page 3 of the Office Action, the Committee further argues that:

> Applicant argues (page 3) that he has over 60 peer-reviewed and published articles. The lack of peer-review is only one reason why applicant's alleged evidence has not been found persuasive, and is still applicable to articles outside these "over 60".
>
> Applicant cites (page 4) MPEP § 716, where the examiner is required to explain why evidence is in sufficient [sic]. This has been done, particularly in the Appendices which applicant faults as being "lengthy" (page 2). As stated in paper no. 20050206, page 4, a refusal to be persuaded is not the same thing as ignoring the evidence.

As discussed above, this latest argument only further exposes the hypocrisy of the Committee's inconsistent positions. Applicant published his confidential data in peer-reviewed journal articles after the Committee required him to do so. Then, when Applicant pointed out that the Committee improperly discounted this evidence as not having been published in peer-reviewed articles, while attributing enhanced credibility to Dr. Souw's peer-reviewed articles that it relied upon, the Committee responds by rejecting Applicant's published evidence anyway simply because other evidence has not yet been published.[144]

The Committee merely reinforces its arbitrary and capricious "allowance is not an option" policy with this latest excuse for ignoring Applicant's scientific data evidencing the lower energy states of hydrogen. The fact that some of Applicant's evidence is still undergoing peer review prior to being published—or even if that evidence is never published—does not detract in the slightest from Applicant's publication of the vast

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[144] As previously noted, despite interference by Dr. Zimmerman—and perhaps by Dr. Park as well—in contacting various journals urging them not to publish Applicant's work, Applicant has been extremely successful in getting his articles published. Since the PTO is relying on the results of the activities of Dr. Zimmerman and/or Dr. Park denying publication of some of Applicant's articles, their involvement and interference in the prosecution of Applicant's pending applications is all the more relevant.

majority of his evidence in highly esteemed scientific journals. Nor does that fact relieve the Patent Office from its duty to properly consider and explain any insufficiency of Applicant's evidence submitted, whether published or not.

Despite the Committee's failure to cite any legal authority for its evidentiary standard requiring such publication of confidential information, Applicant nonetheless complied with it. As previously stated, Applicant now has over 65 peer-reviewed articles published in well-respected scientific journals demonstrating the existence of lower-energy hydrogen. Incredibly, after requiring Applicant to publish his scientific evidence in these journal articles as a precondition to fully and fairly considering that evidence, the Committee has yet to do so. The Committee's statement that it has explained the insufficiency of that evidence in the Souw Appendices does not make it so.

The Committee's reference to Applicant's experimental evidence, which it required Applicant to publish in peer-reviewed journal articles, as "alleged evidence" exposes it propensity to dismiss that evidence out of hand. With regard to the majority of Applicant's peer-reviewed experimental evidence, the Committee has, in fact, provided no comment and, thus, has actively ignored that evidence as correctly stated by Applicant. Furthermore, mere conclusory statements, without adequate reasoning, that the Committee is not "persuaded" by Applicant's evidence is tantamount to ignoring it, consistent with the Committee's "allowance is not an option" policy.

The Committee's dismissal of that evidence as supposedly being unpersuasive, without giving a full explanation, also improperly denies Applicant an opportunity to rebut the Committee's erroneous position. The Committee, however, does exactly that in the present Office Action by unfairly discounting the articles that have been published after passing the peer-review process based on the fact that other articles have not been published. The Committee's unfairness on this point is only exacerbated by the fact that, on numerous occasions, it has touted the credibility of peer-reviewed journal articles. Of course, that was when the Committee was criticizing Applicant's scientific evidence of lower-energy hydrogen, prior to its publication, as "not having the credibility that peer-reviewed articles have." [See, for example, page 5 of the Committee's May 19, 2004 Office Action in U.S. App'n Ser. No. 09/352,693.] But then, even when Applicant's scientific evidence is published in peer-reviewed journal articles, the

Committee refuses to bestow the credibility it admits those peer-reviewed articles deserve due to the fact that some of that evidence has yet to be published.

Applicant can't say he's surprised by the Committee's latest excuse for summarily dismissing his scientific evidence, as this is certainly not the first time he has been subjected to such arbitrary and capricious treatment. The Committee has taken other extreme positions in refusing to consider Applicant's real-world evidence that lower-energy hydrogen actually exists, such as claiming that Applicant's evidence "detract[s] from the central issue that the hydrino does not theoretically exist." [See, for example, May 12, 2005 Advisory Action in U.S. App'n Ser. No. 09/669,877 at page 2 (emphasis added).] Thus, even when Applicant submits scientific evidence that has been peer-reviewed by highly qualified PhD's scientists and published in esteemed scientific journals, as required by the Committee, that credible evidence is rejected because it supposedly "detracts" under a different patentability standard that improperly presumes his invention to be per se incredible.

The Committee merely builds on that nonsensical argument by now claiming that Applicant's scientific evidence that has not been published somehow detracts from that which has been published. Once again, the Committee's treatment of Applicant's evidence in this case has been shown to be blatantly unfair and requires the immediate withdrawal of all pending rejections.

The Committee's statements on pages 2-3 of the Office Action are also without merit:

> Much of applicant's arguments refer to matters which do not pertain to the patentability of his invention, such as allegations of improper contact with a Dr. Robert Park or other "outside influences", discussions with Director Esther Kepplinger, an alleged conflict of interest involving consultory examiner Dr. Bernard Souw, and various statements made by examiners Doug McGinty and Vasu Jaganathan at an interview held on 11 February 2003. Applicant also refers to examiner's statements made in his other applications, which statements have not been made in the present one.

The Committee's reference to Dr. Park and "other outside influences" on the Patent Office have been fully addressed above and no further comments are believed necessary, except to say that the facts established by Applicant regarding this

unfortunate circumstance go directly to the reliability of the pending rejections in this case and the issue of patentability.

Statements made in other applications that are directed to related subject matter are also highly relevant given the obvious inconsistencies and errors contained in those statements. Other circumstances that make such statements relevant include the Committee's consolidation of all of Applicant's cases relating to lower-energy hydrogen with one Examiner, Dr. Souw, under the Committee's direction, and the filing of Appendices prepared by Dr. Souw in those cases. Thus, the Committee's statements and Applicant's responses thereto raise significant issues that are relevant to all of Applicant's cases. It is little wonder the Committee is too embarrassed to directly address its own inconsistent and erroneous statements, which decimate the present rejections.

Dr. Souw's obvious conflict of interest and clear bias in rejecting Applicant's applications also have a direct bearing on the merits of the present rejections and, thus, the patentability of Applicant's invention. To claim otherwise only further demonstrates the extreme bias of the Committee in implementing its "allowance is not an option" policy.

Moreover, statements made by Examiners at Interviews are by definition relevant to the issue of patentability, which is the purpose of conducting Interviews and documenting them in an Interview Summary Form. As a case in point, during one such Interview, Examiner Jaganathan required Applicant to submit all of his experimental evidence for peer-review publication before the PTO would even consider it. Without the Interview and documentation of Examiner Jaganathan's positions, Applicant would have never known of this new "publication standard" required by the PTO, which Applicant has now complied with.

Applicant has also documented other asserted statements made by several different Examiners that have taken part in the prosecution of his applications, which are highly relevant to the issue of patentability. For example, statements made by Examiner Kalafut, Examiner Langel and Examiner Tsang-Foster, demonstrate that the PTO has instituted an "allowance is not option" policy against all of Applicant's

applications. Such a broad policy against issuing Applicant's patent applications is obviously highly relevant to the issue of patentability of those applications.

The conditions under which the PTO originally agreed to allow Applicant's applications are also highly relevant to the issue of patentability. Five of Applicant's applications were allowed and ready to issue as patents, which Director Kepplinger withdrew from issuance. Thus, any comments made by Director Kepplinger regarding that withdrawal are highly relevant to the issue of patentability in all of the Applicant's applications.

Applicant has also included statements made by individuals not employed by the PTO, such as Dr. Zimmerman and Dr. Park. Dr. Zimmerman boasted that the U.S. Department of State and the PTO have fought back with success against Applicant, obviously referring to the withdrawal of Applicant's applications from issuance. Dr. Park, another APS representative, has also bragged of his stopping issuance of Applicant's applications. These statements speak for themselves and the Committee's argument that they do not relate to the patentability of Applicant's applications cannot be serious.

These are but a few examples of the numerous statements and arguments raised by PTO officials, APS representatives, and others, that have a direct bearing on the issue of patentability. The Committee's refusal to address these matters is obviously disappointing, but hardly surprising.

In addition, even if some of the Attachments A-R do not directly relate to the scientific merits of Applicant's invention, that fact does not absolve the Committee of its duty to address all outstanding issues relating to merits of the *rejections* in this case and the improper procedures by which it has been examined. The Committee's arbitrary and capricious refusal to address those issues only gives further credence to the points raised by Applicant in connection with Attachments A – R.

The Committee further argues on pages 3-4 of the pending Final Office Action that:

> Applicant quotes (page 129) in an Office action for another one of his applications, and takes this statement to be an admission that his invention is operable, stating, "Having been forced to recognize the operability of BlackLight's novel hydrogen technology" (BlackLight being the name of applicant's company). This statement was and is intended

only to point out the distinction between the field in which Dr. Souw has worked on the field where applicant alleges, in that particular application, where his invention is applicable, and not as an admission that applicant's invention is operable.

Applicant finds this explanation astonishing given its negative consequences. Even in erroneously denying the operability of Applicant's invention, the Committee is necessarily asserting that there is no real distinction between that field and the one in which Dr. Souw works. The Committee cannot have it both ways, and in trying to do so, it has only dug a hole deeper in admitting Souw's obvious conflict of interest.

Regarding this same issue, the Committee further argues on page 4 of the pending Final Office Action that:

> Applicant argues (page 130) that Dr. Souw's work in the fields of microwave plasmas and CVD analysis "leaves open the possibility that these fields may in fact involve BMS's use of hydrinos in some capacity" (emphasis applicant's; BMS being Dr. Souw's former employer." This does not show any actual or apparent conflict of interest, and is mere speculation.

Applicant finds it interesting that the Committee has chosen to ignore most of Applicant's arguments identifying what is an obvious conflict of interest, and addressing this one. As an initial matter, Applicant notes that, once again, the Committee is misrepresenting that BMS is Dr. Souw's "former employer." As discussed above, Dr. Souw is the founder and current president of BMS, a company he owns. Thus, to Applicant's knowledge, BMS has never been Dr. Souw's employer, but rather, is currently still being run by Dr. Souw.

Furthermore, the Committees' statements criticizing Applicant for supposedly speculating is outrageous given its refusal to divulge information that was reasonably requested by Applicant regarding the specifics of the work Dr. Souw has conducted for BMS. The Committee's failure to cooperate by providing such information only further confirms that Dr. Souw indeed does have a serious conflict of interest.

Conclusion

In conclusion, Applicant will only say that he remains in total disbelief that the

PTO would allow Dr. Souw, with such a flagrant conflict of interest, along with the likes of Drs. Rathke, Zimmerman, and Park, to so corrupt the examination of what is probably the most pioneering invention of our time. To date, Applicant has secured over $50 million in private funding for the research being conducted at BlackLight Power's 53,000-square-foot facility, which research has resulted in the publication of over 65 peer-reviewed articles in esteemed scientific journals. Applicant will not jeopardize that investment by allowing the Committee to treat him like some crazed inventor working out of his garage. Applicant calls for the Committee to stop the nonsense and give him the fair and expeditious hearing to which the Federal Circuit has said he is entitled.

For the foregoing reasons, Applicant respectfully submits that the subject application fully satisfies the legal requirements of 35 U.S.C. §§ 101 and 112, first paragraph, and is therefore in condition for allowance. A Notice to that affect is earnestly solicited.

Respectfully submitted,
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Journal and Book Publications

114. R. Mills, K. Akhtar, B. Dhandapani, "Tests of Features of Field-Acceleration Models for the Extraordinary Selective H Balmer α Broadening in Certain Hydrogen Mixed Plasmas", Journal of Plasma Physics, submitted.

113. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", New Journal of Physics, submitted.

112. R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", International Journal of Hydrogen Energy, submitted.

111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species $H^-(1/4)$ and $H_2(1/4)$ as a New Power Source", Advanced Synthesis and Catalysis, submitted.

110. R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem. 2005, 50(2).

109. R. L. Mills, M. Nansteel, J. He, B. Dhandapani, "Low-Voltage EUV and Visible Light Source Due to Catalysis of Atomic Hydrogen", J. Plasma Physics, submitted.

108. R. L. Mills, J. He, M. Nansteel, B. Dhandapani, "Catalysis of Atomic Hydrogen to New Hydrides as a New Power Source", International Journal of Global Energy Issues (IJGEI), Special Edition in Energy Systems, submitted.

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

105. J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted.

104. R. L. Mills, Y. Lu, M. Nansteel, J. He, A. Voigt, W. Good, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source", Division of Fuel Chemistry, Session: Advances in Hydrogen Energy, 228th American Chemical Society National Meeting, August 22-26, 2004, Philadelphia, PA.

103. R. Mills, B. Dhandapani, W. Good, J. He, "New States of Hydrogen Isolated from K_2CO_3 Electrolysis Gases", Chemical Engineering Science, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", Physics Essays, submitted.

101. R. L. Mills, Y. Lu, M. Nansteel, J. He, A. Voigt, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source", Division of Fuel Chemistry, Session: Chemistry of Solid, Liquid, and Gaseous Fuels, 227th American Chemical Society National Meeting, March 28-April 1, 2004, Anaheim, CA.

100. R. Mills, B. Dhandapani, J. He, "Highly Stable Amorphous Silicon Hydride from a Helium Plasma Reaction", Materials Chemistry and Physics, submitted.

99. R. L. Mills, Y. Lu, B. Dhandapani, "Spectral Identification of $H_2(1/2)$", submitted.

98. R. L. Mills, Y. Lu, J. He, M. Nansteel, P. Ray, X. Chen, A. Voigt, B. Dhandapani, "Spectral Identification of New States of Hydrogen", New Journal of Chemistry, submitted.

97. R. Mills, P. Ray, B. Dhandapani, "Evidence of an Energy Transfer Reaction Between Atomic Hydrogen and Argon II or Helium II as the Source of Excessively Hot H Atoms in RF Plasmas", Journal of Plasma Physics, submitted.

96. J. Phillips, C. K. Chen, R. Mills, "Evidence of the Production of Hot Hydrogen Atoms in RF Plasmas by Catalytic Reactions Between Hydrogen and Oxygen Species", Journal of Plasma Physics, submitted.

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94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

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Upcoming Conference Presentations

Prior Conference Presentations

56. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics Workshop", at the University of Milano di Politechnico, Milan, Italy, Sponsored by the POLITECNICO Foundation, March 3, 2005.

55. R. Mills, "The Hydrino: Lower-level States of the Hydrogen Atom which Have Remarkable Consequences". Invited Evening Lecture at the 17th Symposium of Plasma Physics and Radiation Technology, sponsored by the Netherlands' Physical Society Section Plasma and Gas Discharge Physics and Research School Center for Plasma Physics and Radiation Technology, Lunteren, Netherlands, March 1-2, 2005.

54. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics Workshop", at the University of Eindhoven, Netherlands, February 28, 2005.

53. R. L. Mills, Y. Lu, M. Nansteel, J. He, A. Voigt, W. Good, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source", Division of Fuel Chemistry, Session: Advances in Hydrogen Energy, 228th American Chemical Society National Meeting, August 22-26, 2004, Philadelphia, PA.

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51. R. L. Mills, Y. Lu, M. Nansteel, J. He, A. Voigt, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source", Division of Fuel Chemistry, Session: Chemistry of Solid, Liquid, and Gaseous Fuels, 227th American Chemical Society National Meeting, March 28-April 1, 2004, Anaheim, CA.

50. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source," (Division of Industrial and Engineering Chemistry Symposium), September 9, 2003, 226th American Chemical Society National Meeting, (Sept. 7–11, 2003), New York, NY.

49. B. Dhandapani, R. Mills, "Novel Liquid-Nitrogen-Condensable Molecular Hydrogen Gas" (Physical Chemistry Session) , Wednesday, June 11, 2003, 36th Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.

48. P. Ray, R. Mills, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma" (Physical Chemistry Session) , Wednesday, June 11, 2003, 36th Middle Atlantic Regional

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47. R. Mills, "Novel Catalytic Reaction Of Hydrogen as a Potential New Energy Source" (Catalysis Session), Tuesday, June 10, 2003, 36th Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.

46. J. He, R. Mills, "TOF-SIMS and XPS Studies of Highly Stable Silicon Hydride Films" (Inorganic/Solid State Session), Monday, June 9, 2003, 36th Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.

45. B. Dhandapani, R. Mills, "Low Power MPCVD Synthesis and Characterization of Diamond Films on Silicon Substrates" (Inorganic/Solid State Session) , Monday, June 9, 2003, 36th Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.

44. X. Chen, R. Mills, "Calorimetric Study of Heat Generation by Catalytic Reaction of Atomic Hydrogen in Resonant Transfer Plasmas" (Fuel Cells Session) , Monday, June 9, 2003, 36th Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.

43. R. L. Mills, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Industrial and Engineering Chemistry, "Green Chemistry in the Design of Alternative Energy Strategies", symposium, Oral Presentation, 225th ACS National Meeting, (March 23-27, 2003), New Orleans, LA.

42. R. L. Mills, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Monday, November 25, Room 216, Protocol Center, TA-3, Los Alamos National Laboratory.

41. R. L. Mills, "Classical Quantum Mechanics", Monday, November 25, Room 216, Protocol Center, TA-3, Los Alamos National Laboratory.

40. R. L. Mills, Seminar: "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", US Environmental Protection Agency, National Risk Management Research Laboratory, Sustainable Technologies Division, Cincinnati, OH, October 24, 2002.

39. R. L. Mills, J. Dong, J. He, B. Dhandapani, A. Voigt, M. Nansteel, J. Sankar, R. M. Mayo, P. Ray, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Inorganic Chemistry, Oral Presentation, 224rd ACS National Meeting, (August 18-22, 2002), Boston, MA (Aug. 22, 4:10-4:30 PM).

38. R. L. Mills, J. Dong, J. He, B. Dhandapani, A. Voigt, M. Nansteel, J. Sankar, R. M. Mayo, P. Ray, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Colloidal and Surface Chemistry, Oral Presentation, 224rd ACS National Meeting, (August 18-22, 2002), Boston, MA (Aug. 22, 8:30-8:50 AM).

37. P. Ray, R. Mills, "Spectroscopic Characterization of Stationary Inverted Balmer and Lyman Populations Formed by a Catalytic Reaction of Atomic Hydrogen with Oxygen and with Certain Group I Catalysts", Eighteenth International Conference on Atomic Physics, July 28-August 2, 2002, Cambridge, Massachusetts.

36. R. M. Mayo, R. L. Mills, M. Nansteel, "Direct Plasmadynamic Conversion of Plasma Thermal Power from a Novel Plasma Source to Electricity for Microdistributed Power Applications", 40th Power Sources Conference, (June 6–13, 2002), Cherry Hill, NJ.

35. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Ray, "Spectroscopic Identification of a Novel Catalytic Reaction of Hydrogen", Division of Inorganic Chemistry, Oral Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.

34. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Ray, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Inorganic Chemistry, Oral Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.

33. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Ray, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Industrial and Engineering Chemistry, Oral Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.

32. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Ray, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Catalysis and Surface Science Secretariat, Oral Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.

31. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Ray, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Physical Chemistry, Poster Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.

30. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Ray, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy

Source", Division of Physical Chemistry, Sci-Mix Poster Presentation, 223rd ACS National Meeting, (April 7–11, 2002), Orlando, FL.

29. R. Mills, "BlackLight Power Technology-A New Clean Energy Source with the Potential for Direct Conversion to Electricity", *The 8 th Annual Emerald Groundhog Day Investment Forum*, February 5, 2002, Wyndham Franklin Plaza Hotel, Philadelphia, PA, Organized by Emerald Asset Management, Lancaster, PA.

28. R. L. Mills, E. Dayalan, "Novel Alkali and Alkaline Earth Hydrides for High Voltage and High Energy Density Batteries", Proceedings of the 17th Annual Battery Conference on Applications and Advances, California State University, Long Beach, CA, (January 15-18, 2002), pp. 1-6.

27. P. Ray, R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen plasma", Session ET1: Lighting, American Physical Society Meeting, 54th Annual Gaseous Electronics Conference, October 9–12, 2001, Pennsylvania State University, State College, PA.

26. R. Mills, "Novel catalytic reaction of hydrogen as a potential new energy source", Division of Industrial and Engineering Chemistry; Session: Industrial Bio-Based Technology, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.

25. R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen", Division of Inorganic Chemistry; Session: Catalysis, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.

24. R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen", Division of Physical Chemistry; Session: Physical Chemistry Poster Session, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.

23. R. Mills, J. He, "Spectroscopic Identification of a Novel Catalytic Reaction of Atomic Hydrogen and the Hydride Ion Product", National Hydrogen Association, 12 th Annual U.S. Hydrogen Meeting and Exposition, *Hydrogen: The Common Thread*, The Washington Hilton and Towers, Washington DC, (March 6-8, 2001).

22. R. Mills, B. Dhandapani, M. Nansteel, N. Greenig, S. Hicks, J. Dong, "Optically Measured Power Balances of Anomalous Discharges of Mixtures of Argon, Hydrogen, and Potassium, Rubidium, Cesium, or Strontium Vapor", National Hydrogen Association, 12 th Annual U.S. Hydrogen Meeting and Exposition, *Hydrogen: The Common Thread*, The Washington Hilton and Towers, Washington DC, (March 6-8, 2001).

21. R. Mills, M. Nansteel, N. Greenig, S. Hicks, "BlackLight Power Technology-A New Clean Energy Source with the Potential for Direct Conversion to Electricity", National Hydrogen

Association, 12 th Annual U.S. Hydrogen Meeting and Exposition, *Hydrogen: The Common Thread*, The Washington Hilton and Towers, Washington DC, (March 6-8, 2001).

20. R. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", National Hydrogen Association, 12 th Annual U.S. Hydrogen Meeting and Exposition, *Hydrogen: The Common Thread*, The Washington Hilton and Towers, Washington DC, (March 6-8, 2001).

19. R. Mills, "BlackLight Power Technology-A New Clean Energy Source with the Potential for Direct Conversion to Electricity", *The 8 th Annual Emerald Groundhog Day Investment Forum*, February 1, 2001, Wyndham Franklin Plaza Hotel, Philadelphia, PA, Organized by Emerald Asset Management, Lancaster, PA.

18. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Global Foundation, Inc. Orbis Scientiae entitled *The Role of Attractive and Repulsive Gravitational Forces in Cosmic Acceleration of Particles The Origin of the Cosmic Gamma Ray Bursts*, (29th Conference on High Energy Physics and Cosmology Since 1964) Dr. Behram N. Kursunoglu, Chairman, December 14-17, 2000, Lago Mar Resort, Fort Lauderdale, FL.

17. R. Mills, "BlackLight Power Technology-A New Clean Energy Source with the Potential for Direct Conversion to Electricity", Global Foundation, Inc. conference entitled *Global Warming and Energy Policy*, Fort Lauderdale, FL, November 26-28, 2000.

16. R. Mills, B. Dhandapani, N. Greenig, J. He, J. Dong, Y. Lu, and H. Conrads, "Formation of an Energetic Plasma and Novel Hydrides from Incandescently Heated Hydrogen Gas with Certain Catalysts", August National ACS Meeting (220th ACS National Meeting, Washington, DC, (August 20-24, 2000)).

15. R. Mills, J. He, and B. Dhandapani, "Novel Alkali and Alkaline Earth Hydrides", August National ACS Meeting (220th ACS National Meeting, Washington, DC, (August 20-24, 2000)).

14. R. Mills, B. Dhandapani, N. Greenig, J. He, J. Dong, Y. Lu, and H. Conrads, "Formation of an Energetic Plasma and Novel Hydrides from Incandescently Heated Hydrogen Gas with Certain Catalysts", June ACS Meeting (29th Northeast Regional Meeting, University of Connecticut, Storrs, CT, (June 18-21, 2000)).

13. Mills, J. Dong, N. Greenig, and Y. Lu, "Observation of Extreme Ultraviolet Hydrogen Emission from Incandescently Heated Hydrogen Gas with Certain Catalysts", 219 th National ACS Meeting, San Francisco, California, (March 26-30, 2000).

12. R. Mills, B. Dhandapani, N. Greenig, J. He, J. Dong, Y. Lu, and H. Conrads, "Formation of an Energetic Plasma and Novel Hydrides from Incandescently Heated Hydrogen Gas with Certain Catalysts", 219 th National ACS Meeting, San Francisco, California, (March 26-30, 2000).

11. R. Mills, "Novel Hydride Compound", 219 th National ACS Meeting, San Francisco, California, (March 26-30, 2000).

10. R. Mills, J. He, and B. Dhandapani, "Novel Alkali and Alkaline Earth Hydrides", 219 th National ACS Meeting, San Francisco, California, (March 26-30, 2000).

9. R. Mills, J. Dong, N. Greenig, and Y. Lu, "Observation of Extreme Ultraviolet Hydrogen Emission from Incandescently Heated Hydrogen Gas with Certain Catalysts", National Hydrogen Association, 11 th Annual U.S. Hydrogen Meeting, Vienna, VA, (February 29-March 2, 2000).

8. R. Mills, B. Dhandapani, N. Greenig, J. He, J. Dong, Y. Lu, and H. Conrads, "Formation of an Energetic Plasma and Novel Hydrides from Incandescently Heated Hydrogen Gas with Certain Catalysts", National Hydrogen Association, 11 th Annual U.S. Hydrogen Meeting, Vienna, VA, (February 29-March 2, 2000).

7. R. Mills, "Novel Hydride Compound", National Hydrogen Association, 11 th Annual U.S. Hydrogen Meeting, Vienna, VA, (February 29-March 2, 2000).

6. R. Mills, J. He, and B. Dhandapani, "Novel Alkali and Alkaline Earth Hydrides", National Hydrogen Association, 11 th Annual U.S. Hydrogen Meeting, Vienna, VA, (February 29-March 2, 2000).

5. R. Mills, J. Dong, Y. Lu, J. Conrads, "Observation of Extreme Ultraviolet Hydrogen Emission from Incandescently Heated Hydrogen Gas with Certain Catalysts", 1999 Pacific Conference on Chemistry and Spectroscopy and the 35th ACS Western Regional Meeting, Ontario Convention Center, California, (October 6-8, 1999).

4. R. Mills, "Novel Hydride Compound", 1999 Pacific Conference on Chemistry and Spectroscopy and the 35th ACS Western Regional Meeting, Ontario Convention Center, California, (October 6-8, 1999).

3. R. Mills, B, Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", 1999 Pacific Conference on Chemistry and Spectroscopy and the 35th ACS Western Regional Meeting, Ontario Convention Center, California, (October 6-8, 1999).

2. R. Mills, J. He, and B. Dhandapani, "Novel Hydrogen Compounds", 1999 Pacific Conference on Chemistry and Spectroscopy and the 35th ACS Western Regional Meeting, Ontario Convention Center, California, (October 6-8, 1999).

1. R. Mills, "Excess Heat Production by the Electrolysis of an Aqueous Potassium Carbonate Electrolyte", August 1991 meeting of the American Chemical Society, NY, NY.

APPENDIX

Response to Bernard E. Souw Appendix Attached to
May 9, 2006 Final Office Action in U.S. App'n Ser. No. 09/110,717

The anonymous group of PTO officials and other unknown members that constitute the Secret Committee responsible for handling this and other BlackLight applications have relied heavily on arguments presented by Examiner Souw in various Appendices attached to previous Office Actions. Applicant responded by filing his own Appendices that raised points discrediting those arguments and further highlighting the Committee's failure to seriously consider Applicant's scientific evidence proving the existence of lower-energy hydrogen. Many of those points stand unrebutted and, therefore, weigh heavily in favor of allowing the pending claims in this case to issue.

In an attempt to counter a few of those points, the Committee now responds with additional arguments presented by Examiner Souw in yet another Appendix attached to the present Advisory Action, which still does little to advance the prosecution of this application. [Souw Appendix IV] To the contrary, these newly presented arguments expose an even greater disregard for Applicant's scientific evidence, in which Examiner Souw: (1) misstates proper standards for evaluating that evidence, thereby unfairly creating new standards; (2) misinterprets experimental data (even misreading a simple figure); and (3) misunderstands basic scientific concepts resulting in the improper invalidation of Applicant's evidence, such as his XPS and water bath calorimetry data.

Applicant's discussion herein tracks all of these arguments and rebuts them point by point, calling into question the extent to which his scientific evidence has received a fair hearing. From this discussion, it is clear that the Examiner, unable to refute that evidence on scientific grounds, resorts to mere hand waving to dismiss the data.[1]

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[1] In each of the Sections below, the language quoted from Examiner's Souw's Appendix contains typographical errors in regards to the formulae. Given the extremely short time period for responding to the pending Advisory Action, Applicant did not have sufficient time to correct the formulae. Thus, when in doubt as to the correct formulae, please refer to the original text of his Attachment.

Section 25[2]

In the Section of Examiner Souw's Appendix entitled "I. Experimental Part," under "(A) General Arguments" the Examiner begins on page 1 by claiming:

Applicant's alleged "evidence" falls into three categories:

(a) Those published by Applicant himself, his own company Blacklight Power Inc. (hereinafter BLP) and/or its subsidiaries, including companies paid by BLP to do work on BLP's behalf, all of which report results which are in contradiction to those obtained by independent third parties. In this regard, **all** attempts carried out by independent third parties to reproduce Applicant's claimed results have failed [1, 2]. Thus, Applicant's publications of this category are not considered as supports for the patentability of the present invention, since their results are deemed incredible. Falling under this category are publications nos. 7, 13-15 (sponsored by BLP), 17, 20-43 and 46-47.

As given in Section Nos. 20-24 of the Attachment, the results of Cvetanovic and possibly the results of Jovicevic et al. actually confirm Applicant's results. Furthermore, it is absurd to imply that the very prestigious researchers and research institutions that are listed in the 51 independent validations provide in the section entitled "Independent Test Results" are falsifying data or providing misleading statements. The only evidence of such is that of the detractors as given in Section 21 of the Attachment.

Section 26

The second evidentiary category identified by Examiner Souw on page 1 of his Appendix is:

(b) Those published in non-peer-reviewed journals, as already identified in previous Office Action(s)

Applicant's results are published in over 60 peer-reviewed journal articles and the remaining are expected to be published as well. The Examiner's refusal to recognize this fact merely confirms his bias, as discussed at length in Applicant's main response.

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[2] Sections 1-24 are are provided in the Attachment and refer to arguments made in U.S. Appl'n Ser. No. 09/009,455.

Section 27

The third and final evidentiary category identified by Examiner Souw on page 2

of his Appendix is:

> (c) Those claiming observations unrelated and/or irrelevant to hydrino,
> such as excessive line broadening, novel peaks (either plasma or solid
> state spectroscopy), excess heat, enhanced radiation, i.e., phenomena
> explainable by conventional physics (e.g., impurities that evidently
> disappeared after surface cleaning [3]), while totally lacking any hard
> evidence (such as material hardness measurement), as already identified
> in previous Office Actions. To this category belong publications nos. 1-6,
> 8-12, 16, 18-19, 44, and 45.

Here again, the Examiner shows his bias. All of the results presented by

Applicant confirm his technology.

Excessive line broadening cannot be explained by conventional methods, such

as field acceleration, and demonstrates the energetic reaction of hydrogen to lower-

energy states. See:

51. J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted.
109. R. L. Mills, M. Nansteel, J. He, B. Dhandapani, "Low-Voltage EUV and Visible Light Source Due to Catalysis of Atomic Hydrogen", J. Plasma Physics, submitted.
108. R. L. Mills, J. He, M. Nansteel, B. Dhandapani, "Catalysis of Atomic Hydrogen to New Hydrides as a New Power Source", International Journal of Global Energy Issues (IJGEI), Special Edition in Energy Systems, submitted.
81. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", European Physical Journal-Applied Physics, Vol. 28, (2004), pp. 83-104.
54. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Catalysts", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1504-1509.
51. R. Mills, P. Ray, R. M. Mayo, "CW HI Laser Based on a Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Group I Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 2, (2003), pp. 236-247.
49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 3, (2003), pp. 338-355.

46. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population and a Very Stable Novel Hydride Formed by a Catalytic Reaction of Atomic Hydrogen and Certain Catalysts", Optical Materials, Vol. 27, (2004), pp. 181-186.
42. R. L. Mills, P. Ray, "A Comprehensive Study of Spectra of the Bound-Free Hyperfine Levels of Novel Hydride Ion $H^-(1/2)$, Hydrogen, Nitrogen, and Air", Int. J. Hydrogen Energy, Vol. 28, No. 8, (2003), pp. 825-871.

Novel peaks (either plasma or solid state spectroscopy) show the energy levels of hydrino directly. See:

112. R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", Central European Journal of Physics, submitted.
111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species $H^-(1/4)$ and $H_2(1/4)$ as a New Power Source", Thermochimica Acta, submitted.
110. R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem. 2005, 50(2).
67. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.

Excess heat-direct measurement of the enthalpy of formation of hydrinos and can not be explained by conventional chemistry. See:

77. J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat in 'Resonance Transfer' Plasmas", Journal of Applied Physics, Vol. 96, No. 6, pp. 3095-3102.

"Enhanced radiation" with over 1000 times more light is observed for power input than in a conventional light source, which confirms the power source of the catalysis of hydrogen to lower-energy states. See:

52. R. Mills and M. Nansteel, P. Ray, "Bright Hydrogen-Light Source due to a Resonant Energy Transfer with Strontium and Argon Ions", New Journal of Physics, Vol. 4, (2002), pp. 70.1-70.28.
20. R. Mills and M. Nansteel, P. Ray, "Argon-Hydrogen-Strontium Discharge Light Source", IEEE Transactions on Plasma Science, Vol. 30, No. 2, (2002), pp. 639-653.
16. R. Mills, M. Nansteel, and P. Ray, "Excessively Bright Hydrogen-Strontium Plasma

Light Source Due to Energy Resonance of Strontium with Hydrogen", J. of Plasma Physics, Vol. 69, (2003), pp. 131-158.

Examiner Souw's comment that Applicant's observations are simply "phenomena explainable by conventional physics (e.g., impurities that evidently disappeared after surface cleaning [3])," has no basis. As Applicant has demonstrated, conventional physics can not explain these observations

Similarly, the Examiner's further statement claiming that Applicant's observations are "totally lacking any hard evidence (such as material hardness measurement), as already identified in previous Office Actions," also lacks merit. Applicant has provided data on novel properties, such as extraordinary stability to oxidation

61. R. L. Mills, B. Dhandapani, J. He, "Highly Stable Amorphous Silicon Hydride", Solar Energy Materials & Solar Cells, Vol. 80, No. 1, (2003), pp. 1-20.

and behavior of hydrides as organic molecules in chromatographic analysis and extraordinary stability in water:

38. R. Mills, E. Dayalan, P. Ray, B. Dhandapani, J. He, "Highly Stable Novel Inorganic Hydrides from Aqueous Electrolysis and Plasma Electrolysis", Electrochimica Acta, Vol. 47, No. 24, (2002), pp. 3909-3926.
10. R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.
9. R. Mills, "Novel Inorganic Hydride", Int. J. of Hydrogen Energy, Vol. 25, (2000), pp. 669-683.
8. R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", Int. J. of Hydrogen Energy, Vol. 26, No. 4, (2001), pp. 339-367.

Further, the relationship of the data to hydrino validation is given in the section entitled "Lower-Energy Hydrogen Experimental Data".

Section 28

On page 2 of the Appendix, Examiner Souw draws the outrageous comparison of Applicant's invention to "crop circles," which statements Applicant requests be stricken from the record:

<u>The Examiner's rejection of "evidences" of category (a) to (c) remains the
same, and is summarized as follows:</u>

(A.1) Peculiarity or anomaly alone is by far not sufficient as "evidence".
There are a great abundance of peculiarities and anomalies in this world,
from "irreducibly complex molecular machines" to **"crop circles"**. Many
are hoaxes, and some are genuine phenomena waiting to be resolved by
true science. However, hydrino is here excluded as a possible cause for
the peculiarities and anomalies presented on pgs. 1-37, not only because
there is no evidence for its existence, but additionally, because the
underlying theory, the Grand Unified Theory of Classical Quantum
Mechanics, hereinafter GUT, has now been proven totally invalid as a
scientific theory (see part II of this Appendix) owing to the incredibly large
number of mathematical flaws and violations of known physical laws.
There are still many plausible causes instead of the incredible hydrino that
may be responsible for the peculiarities and anomalies cited in Applicant
papers listed on pgs. 1-37, a few of which have been discussed in
previous Office Action(s) and will be consequently prosecuted in the
following sections. [Emphasis added.]

Perhaps "crop circles" and hoaxes are high on Examiner Souw's mind since they
are akin to aspects of SQM upon which his world view is based and provides the
framework (or lack there of) for the interpretation of the real-world evidence provided by
Applicant. The Examiner has the theory issue directly reversed. Quantum mechanics
involves "spooky actions," virtual particles in every point in space, infinities, polarization
of the vacuum, lack of Einstein causality, negative kinetic energy states including infinite
ones, paradoxes, mysteries, postulates, and enigmas. It has as its parameter Psi,
which has no physical basis.

In stark contrast, Applicant's work is based on applying Maxwell's equations and
Newtonian mechanics as well as special relativity to solve atomic problems. The results
of closed-form equations with fundamental constants only that match 100's of
observables can not be matched by SQM, which is merely a non predictive exercise in
curve fitting with computers. Furthermore, the data presented by Applicant
overwhelmingly confirms hydrino by direct spectral identification and by the
identification of the conjugate observables associated with its formation.

Results include confirmation by at least 11 different techniques that are all
showing different aspects of the same thing: a powerful reaction of atomic hydrogen

and the formation of hydrino. These include: (1) a match between the catalysts and the observed emission for the hydrino reaction, (2) signatures of energetic reactions, including extraordinarily hot hydrogen atoms, the predicted formation of plasma, and energetic pumping (excitation) of hydrogen states, (3) large heat of the formation of hydrino, (4) the spectral emission of lower-energy hydrogen atoms, (5) the spectral emission from vibration and rotation of the hydrino molecule, (6) the observation of the corresponding hydrino hydride ion by emission spectroscopy that can not be assigned to any known species, (7) the predicted NMR signature from the hydride ion and the corresponding gas molecule, (8) the binding energy of the molecule and the hydride ion measured by mass spectroscopy and X-ray photoelectron spectroscopy, respectively, (9) the rotational emission of the molecules trapped in the hydride compounds with electron-beam excitation, (10) the isolation and characterization of chemical compounds containing the new hydrides ions that show extraordinary properties and analytical signatures, and most significantly, (11) the exact spectrum predicted for the single-rotational transition of hydrino molecules trapped in the solid compounds. The energies, intensities, line widths, and peak spacing match theory identically, and the results match the body of other evidence from independent techniques. A summary is given in the section entitled "Lower-Energy Hydrogen Experimental Data".

See Applicant's papers such as:

111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species $H^-(1/4)$ and $H_2(1/4)$ as a New Power Source", Thermochimica Acta, submitted.

ABSTRACT

The data from a broad spectrum of investigational techniques strongly and consistently indicates that hydrogen can exist in lower-energy states then previously thought possible. The predicted reaction involves a resonant, nonradiative energy transfer from otherwise stable atomic hydrogen to a catalyst capable of accepting the energy. The product is $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein $n=\frac{1}{2},\frac{1}{3},\frac{1}{4},...,\frac{1}{p}$; ($p \le 137$ is an integer) replaces the well known parameter $n =$ integer in the Rydberg equation for hydrogen excited states. He^+, Ar^+, and K are predicted to serve as catalysts since they meet the

catalyst criterion—a chemical or physical process with an enthalpy change equal to an integer multiple of the potential energy of atomic hydrogen, $27.2\ eV$. Specific predictions based on closed-form equations for energy levels were tested. For example, two $H(1/p)$ may react to form $H_2(1/p)$ that have vibrational and rotational energies that are p^2 times those of H_2 comprising uncatalyzed atomic hydrogen. Rotational lines were observed in the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)$.

The predicted products of alkali catalyst K are $H^-(1/4)$ which form $KH*X$, a novel alkali halido (X) hydride compound, and $H_2(1/4)$ which may be trapped in the crystal. The ^1H MAS NMR spectrum of novel compound $KH*Cl$ relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 ppm corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of $H^-(1/p)$ with $p = 4$. The predicted frequencies of ortho and para-$H_2(1/4)$ were observed at 1943 cm^{-1} and 2012 cm^{-1} in the high resolution FTIR spectrum of $KH*I$ having a -4.6 ppm NMR peak assigned to $H^-(1/4)$. The 1943/2012 cm^{-1}-intensity ratio matched the characteristic ortho-to-para-peak-intensity ratio of 3:1, and the ortho-para splitting of 69 cm^{-1} matched that predicted. $KH*Cl$ having $H^-(1/4)$ by NMR was incident to the 12.5 keV electron-beam which excited similar emission of interstitial $H_2(1/4)$ as observed in the argon-hydrogen plasma. KNO_3 and Raney nickel were used as a source of K catalyst and atomic hydrogen, respectively, to produce the corresponding exothermic reaction. The energy balance was $\Delta H = -17,925\ kcal/mole\ KNO_3$, about 300 times that expected for the most energetic known chemistry of KNO_3, and $-3585\ kcal/mole\ H_2$, over 60 times the hypothetical maximum enthalpy of $-57.8\ kcal/mole\ H_2$ due to combustion of hydrogen with atmospheric oxygen, assuming the maximum possible H_2 inventory. The reduction of KNO_3 to water, potassium metal, and NH_3 calculated from the heats of formation only releases $-14.2\ kcal/mole\ H_2$ which can not account for the observed heat; nor can hydrogen combustion. But, the results are consistent with the formation of $H^-(1/4)$ and $H_2(1/4)$ having enthalpies of formation of over 100 times that of combustion.

Section 29

On page 2 of his Appendix, Examiner Souw erroneously summarizes Applicant's scientific evidence as follows:

To summarize, Applicant's results are either (a) disproved by independent third party researchers (e.g., Marchese et al. [1] and EarthTech [2]; see B.3(c) below), or (b) explained by others as being due to causes other than hydrino (e.g., Fan et al. [3] and Luggenhoelscher [see previous Appendix]).

Marchese et al. validated Applicant's results as reported :

44. **A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002, http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf.**

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel performed verification studies as visiting researchers at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of extraordinarily broadened atomic hydrogen lines, population inversion, lower-energy hydrogen lines, and excess power measured by water bath calorimetry were replicated. The application of the energetic hydrogen to propulsion was studied.

Specifically, the data supporting hydrinos was replicated. See

i.) BlackLight Process Theory (pp. 10-12) which gives the theoretical energy levels for hydrinos and the catalytic reaction to form hydrinos,

ii.) Unique Hydrogen Line Broadening in Low Pressure Microwave Water Plasmas (pp. 25-27, particularly Fig. 21) which shows that in the same microwave cavity driven at the same power, the temperature of the hydrogen atoms in the microwave plasma where the hydrino reaction was active was 50 times that of the control based on the spectroscopic line widths,

iii.) Inversion of the Line Intensities in Hydrogen Balmer Series (pp. 27-28, particularly Fig. 22) which shows for the first time in 40 years of intensive worldwide research that atomic hydrogen population inversion was achieved in a steady state plasma and supports the high power released from the reaction of hydrogen to form hydrinos,

iv.) Novel Vacuum Ultraviolet (VUV) Vibration Spectra of Hydrogen Mixture Plasmas (pp. 28-29, particularly Fig. 23) which shows a novel vibrational series of lines in a helium-hydrogen plasmas at energies higher than any known vibrational series and it identically matches the theoretical prediction of 2 squared times the corresponding vibration of the ordinary hydrogen species, and

v.) Water Bath Calorimetry Experiments Showing Increased Heat Generation (pp. 29-30, particularly Fig. 25) that shows that with exactly the same system and same input power, the heating of the water reservoir absolutely measured to 1% accuracy was equivalent to 55 to 62 W with

the catalyst-hydrogen mixture compared to 40 W in the control without the possibility of the reaction to form hydrinos.

EarthTech is also Applicant's competitor; so, their results can not be considered without bias. Many other independent laboratories including INEL, NASA Lewis, MIT Lincoln Labs, Chalk River, and other have validated Applicant's experiments (See the section entitled "Independent Test Results") that were attempted unsuccessfully by EarthTech, which shows that the failure rests on EarthTech, not Applicant's technology.

Regarding Luggenhoelscher, the Examiner is confused. He can not have it both ways by claiming that Luggenhoelscher data does not show an effect as stated in Section 18 of the Attachment and here he says that Luggenhoelscher does show line broadening that can be due to some other explanation. The Souw Appendix is full of internal inconsistencies like these, which render the Examiner's analysis null and void.

Section 30

Examiner Souw demonstrates further confusion by arguing on page 3 of the Appendix that:

> Specifically responding to Applicant's statement on pg.17, it is not the Examiner's duty or responsibility to present any alternative explanation; it is sufficient to show that the observed anomaly cannot be due to "hydrino". It is the Examiner's duty and responsibility to reject any mechanism that is scientifically impossible, such as the hypothetical effects due to "hydrino", since there is no evidence that "hydrino" exists, and furthermore, its existence has been proven scientifically impossible. Such a rejection is made possible by the MPEP under 35 U.S.C. § 101 and §112/¶.1.

This statement has no credibility given the evidence summarized in Section 2 of the Attachment and Section 28 above. Examiner Souw's statement of "proven scientifically impossible" is not supported by any physical argument since of course energy is released if the electron transitions to an orbit closer to the nucleus. The Examiner is only left with the absence of the prior discovery and unfound theoretical arguments as described in Sections 1-4 of the Attachment. The latter is probably responsible for the former.

Section 31

The Examiner continues his biased analysis of Applicant's evidence by stating on page 3 of the Appendix:

> (A.2) Applicant's "evidence" is unpersuasive, because NONE of them is hard evidence, but all are invariably argued over some anomalies, such as excessive line broadening, anomalous peaks (in either plasma or solid state spectroscopy), excess heat, enhanced radiation, etc., which do not count, and hence, unpersuasive.

Applicant's experimental evidence provides direct identification of lower-energy hydrogen, with many conjugate parameters, as discussed in Section 2 of the Attachment and in Sections 27-28 above.

Section 32

Examiner Souw attempts to further disparage Applicant's evidence on page 3 of the Appendix, but succeeds only in revealing his own analytical shortcomings in the process:

> Regarding evidence, a claim of strong bonding must be validated by <u>measurement of material hardness</u>, but not through unpersuasive arguments over <u>peculiar lines that are irrelevant for being hardly above the noise level</u>, as done by Applicant.

The Examiner's position is nonsensical. Nitrogen, for example, has a very high bond energy, but is not hard. Applicant has measured the bonding in lower-energy hydrogen by the "gold standard," vibration-rotational spectroscopy. See

112. **R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", Central European Journal of Physics, submitted.**

The data from a broad spectrum of investigational techniques strongly and consistently indicates that hydrogen can exist in lower-energy states then previously thought possible. Novel emission lines with energies of $q \cdot 13.6 \, eV$ where $q = 1,2,3,4,6,7,8,9,11$ were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p}; \ (p \leq 137 \text{ is an integer}) \text{ replaces the well known}$$

parameter n = integer in the Rydberg equation for hydrogen excited states. Evidence supports that these states are formed by a resonant nonradiative energy transfer to He^+ acting as a catalyst. Ar^+ and K also serve as catalysts since, like He^+, they meet the catalyst criterion—a chemical or physical process with an enthalpy change equal to an integer multiple of the potential energy of atomic hydrogen, 27.2 eV.

Two $H(1/p)$ may react to form $H_2(1/p)$ that have vibrational and rotational energies that are p^2 times those of H_2 comprising uncatalyzed atomic hydrogen. Rotational lines were observed in the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)$. The predicted products of alkali catalyst K are $H^-(1/4)$ which form a novel alkali halido hydride compound ($MH * X$) and $H_2(1/4)$ which may be trapped in the crystal. The ^1H MAS NMR spectrum of novel compound $KH * Cl$ relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 ppm corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of $H^-(1/p)$ with p = 4. The predicted catalyst reactions, position of the upfield-shifted NMR peaks for $H^-(1/4)$, and spectroscopic data for $H^-(1/4)$ were found to be in agreement with the experimental observations as well as previously reported analysis of $KH * Cl$ containing this hydride ion.

The predicted frequencies of ortho and para-$H_2(1/4)$ were observed at 1943 cm^{-1} and 2012 cm^{-1} in the high resolution FTIR spectrum of $KH * I$ having a -4.6 ppm NMR peak assigned to $H^-(1/4)$. The 1943/2012 cm^{-1}-intensity ratio matched the characteristic ortho-to-para-peak-intensity ratio of 3:1, and the ortho-para splitting of 69 cm^{-1} matched that predicted. $KH * Cl$ having $H^-(1/4)$ by NMR was incident to the 12.5 keV electron-beam which excited similar emission of interstitial $H_2(1/4)$ as observed in the argon-hydrogen plasma. $H_2(1/p)$ gas was isolated by liquefaction of plasma gas at liquid nitrogen temperature and by decomposition of compounds ($MH * X$) found to contain the corresponding hydride ions $H^-(1/p)$. The $H_2(1/p)$ gas was dissolved in $CDCl_3$ and characterized by ^1H NMR. Considering solvent effects, singlet peaks upfield of H_2 were observed with a predicted integer spacing of 0.64 ppm at 3.47, 3.02, 2.18, 1.25, 0.85, and 0.22 ppm which matched the consecutive series $H_2(1/2)$, $H_2(1/3)$, $H_2(1/4)$, $H_2(1/5)$, $H_2(1/6)$, and $H_2(1/7)$, respectively.

Excess power was absolutely measured from the helium-hydrogen plasma. For an input of 41.9 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 62.1 W corresponding to 20.2 W of excess power in 3 cm^3 plasma volume. The excess power density and energy balance were high, $6.7\ W/cm^3$ and $-5.4\ X10^4\ kJ/mole\ H_2$ ($280\ eV/H\ atom$), respectively. In addition to power applications, battery and propellant reactions are proposed that may be transformational, and observed excited vibration-rotational levels of $H_2(1/4)$ could be the basis of a UV laser that could significantly advance photolithography.

111. **R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species $H^-(1/4)$ and $H_2(1/4)$ as a New Power Source", Thermochimica Acta, submitted.**

The data from a broad spectrum of investigational techniques strongly and consistently indicates that hydrogen can exist in lower-energy states then previously thought possible. The predicted reaction involves a resonant, nonradiative energy transfer from otherwise stable atomic hydrogen to a catalyst capable of accepting the energy. The product is $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p}; \ (p \le 137 \text{ is an integer}) \text{ replaces the well known}$$

parameter n = integer in the Rydberg equation for hydrogen excited states. He^+, Ar^+, and K are predicted to serve as catalysts since they meet the catalyst criterion—a chemical or physical process with an enthalpy change equal to an integer multiple of the potential energy of atomic hydrogen, $27.2\ eV$. Specific predictions based on closed-form equations for energy levels were tested. For example, two $H(1/p)$ may react to form $H_2(1/p)$ that have vibrational and rotational energies that are p^2 times those of H_2 comprising uncatalyzed atomic hydrogen. Rotational lines were observed in the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)$.

The predicted products of alkali catalyst K are $H^-(1/4)$ which form $KH * X$, a novel alkali halido (X) hydride compound, and $H_2(1/4)$ which may be trapped in the crystal. The ^1H MAS NMR spectrum of novel compound $KH * Cl$ relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 ppm corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of $H^-(1/p)$ with p = 4. The predicted frequencies of ortho and para-$H_2(1/4)$

were observed at 1943 cm^{-1} and 2012 cm^{-1} in the high resolution FTIR spectrum of KH^*I having a -4.6 ppm NMR peak assigned to $H^-(1/4)$. The 1943/2012 cm^{-1}-intensity ratio matched the characteristic ortho-to-para-peak-intensity ratio of 3:1, and the ortho-para splitting of 69 cm^{-1} matched that predicted. KH^*Cl having $H^-(1/4)$ by NMR was incident to the 12.5 keV electron-beam which excited similar emission of interstitial $H_2(1/4)$ as observed in the argon-hydrogen plasma. KNO_3 and Raney nickel were used as a source of K catalyst and atomic hydrogen, respectively, to produce the corresponding exothermic reaction. The energy balance was $\Delta H = -17,925\ kcal/mole\ KNO_3$, about 300 times that expected for the most energetic known chemistry of KNO_3, and $-3585\ kcal/mole\ H_2$, over 60 times the hypothetical maximum enthalpy of $-57.8\ kcal/mole\ H_2$ due to combustion of hydrogen with atmospheric oxygen, assuming the maximum possible H_2 inventory. The reduction of KNO_3 to water, potassium metal, and NH_3 calculated from the heats of formation only releases $-14.2\ kcal/mole\ H_2$ which can not account for the observed heat; nor can hydrogen combustion. But, the results are consistent with the formation of $H^-(1/4)$ and $H_2(1/4)$ having enthalpies of formation of over 100 times that of combustion.

110. **R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem. 2005, 50(2).**

Plasmas of certain catalysts such as K^+, Sr^+, and Ar^+ mixed with hydrogen were studied for evidence of a novel energetic reaction. These hydrogen plasmas called resonant transfer- or rt-plasmas were observed to form at low temperatures (e.g. $\approx 10^3\ K$) and an extraordinary low field strengths of about 1-2 V/cm. Time-dependent line broadening of the H Balmer α line was observed corresponding to extraordinarily fast H (25 eV). Intense hydrogen Lyman emission, a stationary inverted Lyman population, excessive afterglow duration, highly energetic hydrogen atoms, characteristic alkali-ion emission due to catalysis, predicted novel spectral lines, and the measurement of a power beyond any conventional chemistry were also observed. Using a number of spectroscopic and analytical techniques, the reaction products were identified as atoms with energies that are an extension of the Rydberg series to lower states as well as the corresponding molecules and hydride ions. The results show the feasibility of this highly exothermic reaction as a new energy source.

Examiner Souw's refusal to fairly consider this significant evidence displays a level of arrogance that permeates his entire analysis and exposes its glaring weaknesses.

Section 33

In his continued assault on Applicant's scientific evidence, Examiner Souw makes further misstatements on Appendix page 3 that:

> NONE of the experiments done by other independent third party researchers has been able to reproduce Applicant's claimed results [1, 2] (see B.3 .b) below).

This is not true as shown by the 51 independent validations summarized with a listing of the researchers and laboratories in the section entitled "Independent Test Results." Examiner Souw's misstatement merely demonstrates the incompleteness of his analysis based on a disturbing unfamiliarity with the contents of Applicant's submitted evidence.

Section 34

The Examiner continues on pages 3 of the Appendix with the erroneous statement that:

> **(A.3)** **All** of the alleged evidences are only argued based on the fractional energy level of hydrogen, for which there is no theoretical justification (see Part II of this Appendix: Theory).

Nothing could be further from the truth. Essentially all elements were experimentally identified before there was any theory to model their characteristics, including the nonphysical, non-predictive, curve-fitting SQM theory. Applicant's CQM is the first to predict novel lower-energy states of hydrogen. The data confirms the catalysis of hydrogen to these lower-energy states and identifies lower-energy hydrogen. Specially, studies that experimentally confirm a novel reaction of atomic hydrogen which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n = 1$) state, a chemically generated or assisted plasma (rt-plasma), and produces novel hydride compounds are summarized in the section entitled, "Lower-Energy Hydrogen Experimental Data" and include including:

extreme ultraviolet (EUV) spectroscopy,[3]

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[3] Reference Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76, 78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98, 101, 104, 108-112.

characteristic emission from catalysis and the hydride ion products,[4]

lower-energy hydrogen emission,[5]

plasma formation,[6]

Balmer α line broadening,[7]

population inversion of hydrogen lines,[8]

elevated electron temperature,[9]

anomalous plasma afterglow duration,[10]

power generation,[11]

excessive light emission,[12] and

analysis of chemical compounds.[13]

Section 35

In the Section of the Appendix entitled "(B) Specific Arguments," on page 4, Examiner Souw commits further errors in analysis, claiming:

(B.1) Pg.29

> Regarding Applicant's misidentification of the well-known He-II 304 Å line routinely found in solar spectrum as being due to Applicant's non-existent "hydrino" [4] (cited in previous Appendix), the Sun is known to also contain hydrogen and helium. Applicant's attempt to justify Applicant's obvious misidentification of the line by referring to new elements, such as iron, which has no relevance to the disputed 304 Å line, is unpersuasive.

Again, the Examiner has turned a blind eye to the inescapable evidence presented by Applicant. The Novel Lines presented in Ref. [67]: R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied

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[4] Reference Nos. 24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91, 108.

[5] Reference Nos. 14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98, 101, 104, 110-112.

[6] Reference Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93, 108, 109.

[7] Reference Nos. 16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91, 92, 93, 95-97, 105, 108, 109.

[8] Reference Nos. 39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91.

[9] Reference Nos. 34-37, 43, 49, 63, 67, 73.

[10] Reference Nos. 12-13, 47, 81.

[11] Reference Nos. 30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98, 101, 104, 108, 110-112.

[12] Reference Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72. 109

[13] Reference Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100, 101, 104, 108, 110-112.

Physics, Vol. 36, (2003), pp. 1535-1542 can be Explained as Electronic Transitions to Fractional Rydberg States of Atomic Hydrogen:

• The novel peaks fit two empirical relationships.

• In order of energy, the set comprising the peaks at $91.2\ nm$, $45.6\ nm$, $30.4\ nm$, $13.03\ nm$, $10.13\ nm$, and $8.29\ nm$ correspond to energies of $q \cdot 13.6\ eV$ where $q = 1,2,3,7,9,\ or\ 11$.

• In order of energy, the set comprising the peaks at $63.3\ nm$, $37.4\ nm$, $20.5\ nm$, and $14.15\ nm$ correspond to energies of $q \cdot 13.6 - 21.21\ eV$ where $q = 3,4,6,\ or\ 8$.

• Electronic transitions to fractional Rydberg states given by

$$E_n = -\frac{e^2}{n^2 8\pi\varepsilon_o a_H} = -\frac{13.598\ eV}{n^2} \qquad n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p};\quad p\ \text{is an integer}$$

catalyzed by the resonant nonradiative transfer of $m \cdot 27.2\ eV$ would give rise to a series of emission lines of energies $q \cdot 13.6\ eV$ where q is an integer.

• It is further proposed that the photons that arise from hydrogen transitions may undergo inelastic helium scattering. The general reaction is

$$photon\ (h\nu) + He\ (1s^2) \rightarrow He\ (1s^1 2p^1) + photon\ (h\nu - 21.21\ eV)$$
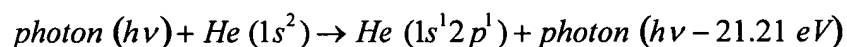
• Then the two empirical series may be combined. The energies for the novel lines in order of energy are $13.6\ eV$, $27.2\ eV$, $40.8\ eV$, $54.4\ eV$, $81.6\ eV$, $95.2\ eV$, $108.8\ eV$, $122.4\ eV$ and $149.6\ eV$. The corresponding peaks are $91.2\ nm$, $45.6\ nm$, $30.4\ nm$ with $63.3\ nm$, $37.4\ nm$, $20.5\ nm$, $13.03\ nm$, $14.15\ nm$, $10.13\ nm$, and $8.29\ nm$, respectively. Thus, the identified novel lines correspond to energies of $q \cdot 13.6\ eV$ where $q = 1,2,3,4,6,7,8,9,\ or\ 11$ or these lines inelastically scattered by helium atoms wherein $21.2\ eV$ was absorbed in the excitation of $He\ (1s^2)$ to $He\ (1s^1 2p^1)$.

Alternative explanations for these lines were eliminated as given for example in Ref. [67]: R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542 and Ref. [98]: R. L. Mills, Y. Lu, J. He, M. Nansteel, P. Ray, X. Chen, A. Voigt, B. Dhandapani, "Spectral Identification of New States of Hydrogen", Applied Spectroscopy, submitted.

From Ref. [98]:

These strong emissions are not found in any single gas plasma, and cannot be assigned to the known emission of any species of the single gases studied such as H, H^-, H_2, H_2^+, H_3^+, He, He_2^*, and He^+, known species of the mixture such as He_2^+, HeH^+, HeH, HHe_2^+, and HHe_n^+ and He_n, possible contaminants [1], or doubly excited states [2]. However the results can be explained by a novel catalytic reaction involving atomic hydrogen [1, 3-6]

From Ref. [67]:

All known possibilities for the series of novel lines were considered. Spectra of species present in helium hydrogen mixtures and possible impurities were evaluated. The only known species in a helium-hydrogen plasmas are H^+, H_2^+, H_3^+, H^-, H, H_2, He_2^*, HeH^+, and remotely possibly HeH. Other exotic possibilities such as He_2^+, HHe_2^+, HHe_n^+ and He_n were eliminated due to the extremely specialized conditions required for their formation such as extremely low temperatures that were unlike those in the helium-hydrogen microwave plasmas [31-32]. The impurities considered were nitrogen, oxygen, carbon dioxide, and water vapor from air, noble gas contaminants, silicon from the quartz tube, and contaminants from the vacuum system.

Regarding hydrogen species as a candidate of the series of novel lines, hydrogen alone has no known emission in this region ($< 77\ nm$) [5-25] as shown in Figure 1. This is a consequence of the binding energies of H, H_2, and H_2^+ being less than 16.3 eV [43-44], and the binding energy of H^- being only 0.75 eV [26]. The reaction to form H_3^+ is exothermic [45]

$$H_2^+ + H_2 \rightarrow H_3^+ + H + 1.7\ eV \tag{1}$$

From Eq. (1), the binding energy of H_3^+ can not be more than 22.43 eV, the sum of the binding energy of H_2^+, 16.25 eV (given by the sum of the bond energy of H_2^+, 2.651 eV [44], and the binding energy of H, 13.59844 eV [43]), the bond energy of H_2, 4.478 eV [44], and 1.7 eV. The corresponding emission is 55.3 nm which is outside of the region of the novel series observed in the region < 50 nm. Furthermore, H_3^+ possesses

no excited electronic states, and consequently has no observable emission in the ultraviolet or visible regions [27]. H_3^+ can only be observed spectroscopically via vibration-rotational transitions which are in the infrared [27-28].

He_2^* emission is limited to the spectral region > 58.4 nm; thus, it was eliminated [29]. HeH^+ was eliminated since excited states of this ion were predicted to be unstable or only weakly bonding [33]. HeH emission was eliminated as the source of the series of novel peaks due to the extraordinarily low probability that HeH would form under the conditions of the helium-hydrogen microwave discharge. The existence of "bound" excited states of HeH has been shown by emission spectroscopy of HeH molecules produced by two ways: (1) by reactions of He and H_2^*, and (2) in charge exchange collisions between HeH^+ and alkali vapors [34-35]. Conditions for either of these types of reactions were not present in the helium-hydrogen microwave plasmas. In addition, the known emission spectrum of HeH was not observed. In particular, HeH has broad emission peaks in the regions of 160-180 nm [36] and 200-400 nm [35] that were not observed in the helium-hydrogen plasmas, nor has the series of novel peaks been recorded on HeH emission. In addition, the novel series does not match the theoretical spectrum of attractive excited states that decay to a repulsive ground state. The theoretical emission of excited states belong to a Rydberg series that converges to the electronic ground state of the HeH^+ ion [34-35].

Air contaminants were also eliminated. Plasmas of nitrogen, oxygen, carbon dioxide, or these gases with 2% hydrogen showed no emission in the region < 50 nm as shown in Figure 5 for hydrogen mixed with nitrogen, oxygen, and carbon dioxide. In addition, water vapor present in the oxygen-hydrogen plasma showed no emission in this region. Nitrogen was further eliminated since the intensity of the $NI\ ^4S-^4P$ peaks of the nitrogen microwave plasma at 113.45 nm and 119.96 nm were 500,000 photons/s; whereas, these peaks were absent from the helium-hydrogen emission recorded with the same sensitivity. The spectrum of nitrogen matched that given in the literature [46] and NIST tables [5]. Similarly oxygen, carbon dioxide, and water vapor (oxygen-hydrogen mixture) were eliminated since O I peaks were observed from each plasma with intensities >100,000 photons/s; whereas, these peaks were absent from the helium-hydrogen emission recorded with the same sensitivity. The peaks that were absent from the helium-hydrogen microwave plasma, but were observed as intense peaks from the oxygen, carbon dioxide, and water vapor microwave plasmas were the O II peak at 83.45 nm and O I peaks at 87.79 nm, 93.5 nm, 99.1 nm, 103.92 nm, 104.09 nm, and 115.21 nm.

Emission of argon, krypton, and xenon as helium contaminants were eliminated. No emission was observed in the region <50 nm for xenon, xenon-hydrogen, krypton, and krypton-hydrogen as shown in Figure 6 for krypton or xenon mixed with hydrogen. In the case of the

argon plasma, only known Ar II and III lines were observed at shorter wavelengths as shown in Figure 7. More significantly, the Ar I lines at 93.2 nm, 104.82 nm, and 106.66 nm have an intensities that are about three orders of magnitude that of the Ar II lines at 48.72 nm, 54.76, and 55.68 nm as observed in the argon control and from NIST tables [5]. This and other lines of argon in the region $50 - 560 \, nm$ were not observed.

Neon has peaks at $45.635 \, nm$ and $45.527 \, nm$. To eliminate the possibility that the $45.6 \, nm$ peak shown in Figures 2-4 was due to the presence of neon as an impurity, the EUV spectra $(25 - 50 \, nm)$ of the helium-hydrogen mixture (98/2%) (top curve) and control neon (bottom curve) microwave discharge cell emission were recorded with a normal incidence EUV spectrometer and a CEM as shown in Figure 8. The novel lines were not observed in the neon control, and a series of Ne II lines were observed only in the control. The neon peaks at $45.635 \, nm$ and $45.527 \, nm$ were resolved in Figure 8; whereas, the $45.6 \, nm$ peak in the helium-hydrogen plasma was about $3 \, nm$ broad. Thus, it was not due to neon impurity. More significantly, the Ne I line at 73.58 nm has an intensity that is about three orders of magnitude that of the Ne II line at $45.635 \, nm$ and $45.527 \, nm$ as observed in the neon control and from NIST tables [5]. This and other lines of neon in the region $50 - 560 \, nm$ were not observed.

Silicon from the quartz tube wall was eliminated since emission due to Si I, Si II, or Si III is not possible below 56 nm based on the NIST tables [5]. Emission from silicon was also eliminated since no silicon lines were observed in any spectrum in the 5-560 nm region. Using the same quartz tube run under identical conditions, no emission was observed in the region of the novel series $(< 50 \, nm)$ in the case of the controls microwave discharge plasmas of hydrogen, nitrogen, oxygen, carbon dioxide, helium, krypton, xenon, or 2% hydrogen mixed with each of these gases except for helium.

Pump contaminants were eliminated. In order for pump contaminates to enter the region of the plasma, they must migrate against the pressure gradient of the differential pumping, $< 10^{-5}$ torr compared to 1 torr. This is highly unlikely. Furthermore, a turbo pump was used which does not have pump oil, and no impurities attributed to pumps were observed in any control spectrum in the 5-560 nm region.

The elimination of known explanations indicate a new result. Since the novel peaks were only observed with helium and hydrogen present, new hydrogen, helium, or helium-hydrogen species are possibilities. It is well known that empirically the excited energy states of atomic hydrogen are given by Rydberg equation (Eq. (2a) for $n > 1$ in Eq. (2b)).

$$E_n = -\frac{e^2}{n^2 8 \pi \varepsilon_o a_H} = -\frac{13.598 \, eV}{n^2} \tag{2a}$$

$$n = 1, 2, 3, \ldots \tag{2b}$$

The $n = 1$ state is the "ground" state for "pure" photon transitions (i.e. the $n = 1$ state can absorb a photon and go to an excited electronic state, but

it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a resonant nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common [47]. Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling [48].
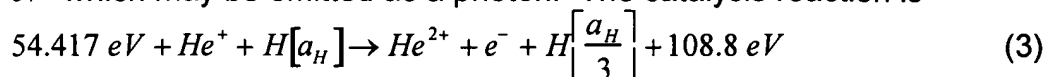
We propose that atomic hydrogen may undergo a catalytic reaction with certain atoms and ions such as He^+ which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \ eV$ wherein m is an integer. The theory was given previously [49]. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots, \frac{1}{p}; \quad p \text{ is an integer}; \quad p \le 137 \tag{2c}$$

replaces the well known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. Thus, the Rydberg states are extended to lower levels as depicted in Figure 9. The $n = 1$ state of hydrogen and the

$n = \dfrac{1}{\text{integer}}$ states of hydrogen are nonradiative, but a transition between

two nonradiative states is possible via a nonradiative energy transfer, say $n = 1$ to $n = 1/2$. Thus, a catalyst provides a net positive enthalpy of reaction of $m \cdot 27.2 \ eV$ (i.e. it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

The novel peaks fit two empirical relationships. In order of energy, the set comprising the peaks at $91.2 \ nm$, $45.6 \ nm$, $30.4 \ nm$, $13.03 \ nm$, $10.13 \ nm$, and $8.29 \ nm$ correspond to energies of $q \cdot 13.6 \ eV$ where $q = 1,2,3,7,9,11$. In order of energy, the set comprising the peaks at $37.4 \ nm$, $20.5 \ nm$, and $14.15 \ nm$ correspond to energies of $q \cdot 13.6 - 21.21 \ eV$ where $q = 4,6,8$. These lines can be explained as electronic transitions to fractional Rydberg states of atomic hydrogen given by Eqs. (2a) and (2c) wherein the catalytic system involves helium ions because the second ionization energy of helium is $54.417 \ eV$, which is equivalent to $2 \cdot 27.2 \ eV$. In this case, $54.417 \ eV$ is transferred nonradiatively from atomic hydrogen to He^+ which is resonantly ionized. The electron decays to the $n = 1/3$ state with the further release of $54.417 \ eV$ which may be emitted as a photon. The catalysis reaction is
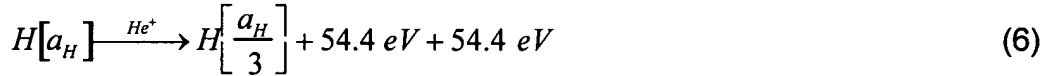
$$54.417 \ eV + He^+ + H[a_H] \rightarrow He^{2+} + e^- + H\left[\frac{a_H}{3}\right] + 108.8 \ eV \tag{3}$$

$$He^{2+} + e^- \rightarrow He^+ + 54.417 \, eV \tag{4}$$

And, the overall reaction is

$$H[a_H] \rightarrow H\left[\frac{a_H}{3}\right] + 54.4 \, eV + 54.4 \, eV \tag{5}$$

Since the products of the catalysis reaction have binding energies of $m \cdot 27.2 \, eV$, they may further serve as catalysts. Thus, further catalytic transitions may occur: $n = \frac{1}{3} \rightarrow \frac{1}{4}, \frac{1}{4} \rightarrow \frac{1}{5}$, and so on.

Electronic transitions to Rydberg states given by Eqs. (2a) and (2c) catalyzed by the resonant nonradiative transfer of $m \cdot 27.2 \, eV$ would give rise to a series of emission lines of energies $q \cdot 13.6 \, eV$ where q is an integer. It is further proposed that the photons that arise from hydrogen transitions may undergo inelastic helium scattering. That is, the catalytic reaction

$$H[a_H] \xrightarrow{\;He^+\;} H\left[\frac{a_H}{3}\right] + 54.4 \, eV + 54.4 \, eV \tag{6}$$

yields $54.4 \, eV$ by Eq. (4) and a photon of $54.4 \, eV$ ($22.8 \, nm$). Once emitted, the photon may be absorbed or scattered. When this photon strikes $He \, (1s^2)$, $21.2 \, eV$ may be absorbed in the excitation to $He \, (1s^1 2p^1)$. This leaves a $33.19 \, eV$ ($37.4 \, nm$) photon peak and a $21.21 \, eV$ ($58.4 \, nm$) photon from $He \, (1s^1 2p^1)$. Thus, for helium the inelastic scattered peak of $54.4 \, eV$ photons from Eq. (3) is given by

$$E = 54.4 \, eV - 21.21 \, eV = 33.19 \, eV \; (37.4 \, nm) \tag{7}$$

A novel peak shown in Figures 2-4 was observed at $37.4 \, nm$. Furthermore, the intensity of the $58.4 \, nm$ peak corresponding to the spectra shown in Figure 4 was about 60,000 photons/sec. Thus, the transition $He \, (1s^2) \rightarrow He \, (1s^1 2p^1)$ dominated the inelastic scattering of EUV peaks. The general reaction is

$$photon \, (h\nu) + He \, (1s^2) \rightarrow He \, (1s^1 2p^1) + photon \, (h\nu - 21.21 \, eV) \tag{8}$$

The two empirical series may be combined—one directly from Eqs. (2a, 2c) and the other indirectly with Eq. (8). The energies for the novel lines in order of energy are $13.6 \, eV$, $27.2 \, eV$, $40.8 \, eV$, $54.4 \, eV$, $81.6 \, eV$, $95.2 \, eV$, $108.8 \, eV$, $122.4 \, eV$ and $149.6 \, eV$. The corresponding peaks are $91.2 \, nm$, $45.6 \, nm$, $30.4 \, nm$, $37.4 \, nm$, $20.5 \, nm$, $13.03 \, nm$, $14.15 \, nm$, $10.13 \, nm$, and $8.29 \, nm$, respectively. Thus, the identified novel lines correspond to energies of $q \cdot 13.6 \, eV$, $q = 1,2,3,7,9,11$. or $q \cdot 13.6 \, eV$, $q = 4,6,8$ less $21.2 \, eV$ corresponding to inelastic scattering of these photons by helium atoms due to excitation of $He \, (1s^2)$ to $He \, (1s^1 2p^1)$. The values of q observed are consistent with those expected based on Eq. (5) and the subsequent autocatalyzed reactions as discussed previously [50]. The broad satellite peak at $44.2 \, nm$ show in Figure 2-4 is consistent with the reaction mechanism of a nonradiative transfer to a catalyst followed by emission. There is remarkable agreement between the data and the proposed transitions to fractional Rydberg states and these lines inelastically scattered by helium according to Eq. (8). All other peaks

could be assigned to He I, He II, second order lines, or atomic or molecular hydrogen emission. No known lines of helium or hydrogen explain the $q \cdot 13.6 \, eV$ related set of peaks.

The Examiner cites Applicant's paper, 28. R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322, as failing to identify the 304 Å line as the He II line. The Examiner shows carelessness and has erred since Applicant has assigned the 304 Å to He II. Table 1 of gives:

304	304	$He^+(n=2) \rightarrow He^+(n=1) + 40.8 \, eV$ [b]	7, 8, 9, 10, 12

In the legend appears:

[b] In Figures 7, 8, 9, 10, and 12, the peak corresponding to $He^+(n=3) \rightarrow He^+(n=1) + 48.35 \, eV$ (256 Å) was absent which makes this assignment difficult.

Furthermore, in Sec. IIIA appears:

It is also proposed that the 304 Å peak shown in Figures 7, 8, 9, 10 and 12 was not entirely due to the He II transition. Conspicuously absent was the 256 Å (48.3 eV) line of He II shown in Figures 6 and 8 which implies only a minor He II transition contribution to the 304 Å peak.

The solar spectrum is not the same as the spectrum of a pure helium-hydrogen (98/2%) plasma. The Sun is known to contain the elements even beyond iron (See Table 4.2 of Stix, M., The Sun, Springer-Verlag, Berlin, (1991)). The Examiner fails to get the point that the elements in the controlled spectrum in the laboratory were not the same as the spectrum recorded on the Sun. In the former case, the gas composition was known precisely and controls were run to identify all positive alternative assignments of the emission.

Section 36

Examiner Souw then incorrectly states on page 4 of the Appendix:

In this regard, Applicant's change of argument to *"the observed 304 Å line is not entirely due to ionized helium"* is also unpersuasive because: (1) There is no other element known in the art that may have contributed to the 304 Åline; and (2) It does not remove the fact that Applicant has misidentified the 304 Å line as being due to "hydrino".

Using the proper scientific method, the 304 Å line can not be assigned to He II alone as shown in Section 35 above.

Section 37

Examiner Souw further argues on page 4 of the Appendix:

(B.2) Pg.30

Again, the Examiner is not required to provide alternative explanation; it is sufficient to prove that Applicant's explanation is incredible (see A. 1 above). Since the invention unambiguously claims the effect as being solely due to hydrino, and this hydrino is evidently non-existent, a rejection under 35 U.S.C. § 101 combined with § 112/¶.1 is proper.

This overly simplistic analysis is ripe with errors. As explained below, the Examiner fatally errs in assuming that Applicant's invention is *per se* incredible, without properly considering the scientific experimental evidence of record. The Committee magnifies this error through its twisted logic that there is no amount of evidence Applicant can submit to prove the existence of lower-energy hydrogen due to its supposed "incredibility," as discussed above in the main response. Application of the scientific method demonstrates that hydrino does exist based on direct spectroscopic measurement and measurement of at least 11 conjugate parameters.

Results include confirmation by at least 11 different techniques that are all showing different aspects of the same thing: a powerful reaction of atomic hydrogen and the formation of hydrino. These include (1) a match between the catalysts and the observed emission for the hydrino reaction, (2) signatures of energetic reactions including extraordinarily hot hydrogen atoms, the predicted formation of plasma, and

energetic pumping (excitation) of hydrogen states, (3) large heat of the formation of

hydrino, (4) the spectral emission of lower-energy hydrogen atoms, (5) the spectral

emission from vibration and rotation of the hydrino molecule, (6) the observation of the

corresponding hydrino hydride ion by emission spectroscopy that can not be assigned

to any known species, (7) the predicted NMR signature from the hydride ion and the

corresponding gas molecule, (8) the binding energy of the molecule and the hydride ion

measured by mass spectroscopy and X-ray photoelectron spectroscopy, respectively,

(9) the rotational emission of the molecules trapped in the hydride compounds with

electron-beam excitation, (10) the isolation and characterization of chemical

compounds containing the new hydrides ions that show extraordinary properties and

analytical signatures, and most significantly, (11) the exact spectrum predicted for the

single-rotational transition of hydrino molecules trapped in the solid compounds. The

energies, intensities, line widths, and peak spacing match theory identically, and the

results match the body of other evidence from independent techniques. A summary is

given in the section entitled "Lower-Energy Hydrogen Experimental Data".

See Applicant's papers such as:
111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of
Atomic Hydrogen to Novel Hydrogen Species $H^-(1/4)$ and $H_2(1/4)$ as a
New Power Source", Thermochimica Acta, submitted.

ABSTRACT

The data from a broad spectrum of investigational techniques
strongly and consistently indicates that hydrogen can exist in lower-energy
states then previously thought possible. The predicted reaction involves a
resonant, nonradiative energy transfer from otherwise stable atomic
hydrogen to a catalyst capable of accepting the energy. The product is
$H(1/p)$, fractional Rydberg states of atomic hydrogen wherein

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p} \; ; \; (p \le 137 \text{ is an integer}) \text{ replaces the well known}$$

parameter $n =$ integer in the Rydberg equation for hydrogen excited states.
He^+, Ar^+, and K are predicted to serve as catalysts since they meet the
catalyst criterion—a chemical or physical process with an enthalpy change
equal to an integer multiple of the potential energy of atomic hydrogen,
$27.2 \; eV$. Specific predictions based on closed-form equations for energy
levels were tested. For example, two $H(1/p)$ may react to form $H_2(1/p)$
that have vibrational and rotational energies that are p^2 times those of H_2

comprising uncatalyzed atomic hydrogen. Rotational lines were observed in the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)$.

The predicted products of alkali catalyst K are $H^-(1/4)$ which form KH^*X, a novel alkali halido (X) hydride compound, and $H_2(1/4)$ which may be trapped in the crystal. The ^1H MAS NMR spectrum of novel compound KH^*Cl relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 ppm corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of $H^-(1/p)$ with $p = 4$. The predicted frequencies of ortho and para- $H_2(1/4)$ were observed at 1943 cm^{-1} and 2012 cm^{-1} in the high resolution FTIR spectrum of KH^*I having a -4.6 ppm NMR peak assigned to $H^-(1/4)$. The 1943/2012 cm^{-1}-intensity ratio matched the characteristic ortho-to-para-peak-intensity ratio of 3:1, and the ortho-para splitting of 69 cm^{-1} matched that predicted. KH^*Cl having $H^-(1/4)$ by NMR was incident to the 12.5 keV electron-beam which excited similar emission of interstitial $H_2(1/4)$ as observed in the argon-hydrogen plasma. KNO_3 and Raney nickel were used as a source of K catalyst and atomic hydrogen, respectively, to produce the corresponding exothermic reaction. The energy balance was $\Delta H = -17,925\ kcal/mole\ KNO_3$, about 300 times that expected for the most energetic known chemistry of KNO_3, and $-3585\ kcal/mole\ H_2$, over 60 times the hypothetical maximum enthalpy of $-57.8\ kcal/mole\ H_2$ due to combustion of hydrogen with atmospheric oxygen, assuming the maximum possible H_2 inventory. The reduction of KNO_3 to water, potassium metal, and NH_3 calculated from the heats of formation only releases $-14.2\ kcal/mole\ H_2$ which can not account for the observed heat; nor can hydrogen combustion. But, the results are consistent with the formation of $H^-(1/4)$ and $H_2(1/4)$ having enthalpies of formation of over 100 times that of combustion.

The fact that the Examiner can not find an alternative explanation for all these results is due to scientific fact that there is no alternative explanation.

Section 38

On pages 4-5 of the Souw Appendix, the Examiner again raises nonsensical arguments:

(B.3) Pg.33-35

(a) Strong bonding must be evidenced by measurement of material hardness [5], not by mere arguments of anomalies observed in XPS spectral lines. Anomalies may have many other causes, but not by hydrino. The latter must be excluded, for having neither experimental nor theoretical justification.

The Examiner's position is completely bases. XPS can identify all elements and give information about their oxidation state by directly measuring the binding energy of each electron. These energies are characteristic of and identify each element. The measurement of the binding energy of the hydrino hydride ions is a means of direct identification. There are infinite numbers of combinations of materials that can be categorized along an essentially continuous scale of hardness. Applicant is frankly astonished that the Examiner calls to supplant direct characterization with some nebulous hardness measurement. How then would the Examiner identify any given element in the periodic chart? To understand how those educated in materials characterization identify elements, the Examiner should read, for example, C. D. Wagner, W. M. Riggs, L. E. Davis, J. F. Moulder, G. E. Mulilenberg (Editor), *Handbook of X-ray Photoelectron Spectroscopy*, Perkin-Elmer Corp., Eden Prairie, Minnesota, (1997).

Applicant has measured the predicted binding energy of hydrino hydride using XPS, which is confirmed by other independent analytical techniques as given in:

111. **R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species $H^-(1/4)$ and $H_2(1/4)$ as a New Power Source", Thermochimica Acta, submitted.**

The data from a broad spectrum of investigational techniques strongly and consistently indicates that hydrogen can exist in lower-energy states then previously thought possible. The predicted reaction involves a resonant, nonradiative energy transfer from otherwise stable atomic hydrogen to a catalyst capable of accepting the energy. The product is $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p}; \ (p \le 137 \text{ is an integer}) \text{ replaces the well known}$$

parameter n = integer in the Rydberg equation for hydrogen excited states. He^+, Ar^+, and K are predicted to serve as catalysts since they meet the catalyst criterion—a chemical or physical process with an enthalpy change equal to an integer multiple of the potential energy of atomic hydrogen,

27.2 eV. Specific predictions based on closed-form equations for energy levels were tested. For example, two $H(1/p)$ may react to form $H_2(1/p)$ that have vibrational and rotational energies that are p^2 times those of H_2 comprising uncatalyzed atomic hydrogen. Rotational lines were observed in the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)$.

The predicted products of alkali catalyst K are $H^-(1/4)$ which form $KH*X$, a novel alkali halido (X) hydride compound, and $H_2(1/4)$ which may be trapped in the crystal. The ^1H MAS NMR spectrum of novel compound $KH*Cl$ relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 ppm corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of $H^-(1/p)$ with $p = 4$. The predicted frequencies of ortho and para- $H_2(1/4)$ were observed at 1943 cm^{-1} and 2012 cm^{-1} in the high resolution FTIR spectrum of $KH*I$ having a -4.6 ppm NMR peak assigned to $H^-(1/4)$. The 1943/2012 cm^{-1}-intensity ratio matched the characteristic ortho-to-para-peak-intensity ratio of 3:1, and the ortho-para splitting of 69 cm^{-1} matched that predicted. $KH*Cl$ having $H^-(1/4)$ by NMR was incident to the 12.5 keV electron-beam which excited similar emission of interstitial $H_2(1/4)$ as observed in the argon-hydrogen plasma. KNO_3 and Raney nickel were used as a source of K catalyst and atomic hydrogen, respectively, to produce the corresponding exothermic reaction. The energy balance was $\Delta H = -17,925$ $kcal/mole$ KNO_3, about 300 times that expected for the most energetic known chemistry of KNO_3, and -3585 $kcal/mole$ H_2, over 60 times the hypothetical maximum enthalpy of -57.8 $kcal/mole$ H_2 due to combustion of hydrogen with atmospheric oxygen, assuming the maximum possible H_2 inventory. The reduction of KNO_3 to water, potassium metal, and NH_3 calculated from the heats of formation only releases -14.2 $kcal/mole$ H_2 which can not account for the observed heat; nor can hydrogen combustion. But, the results are consistent with the formation of $H^-(1/4)$ and $H_2(1/4)$ having enthalpies of formation of over 100 times that of combustion.

110. **R. L. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrides as a New Power Source," Prepr. Pap.-Am. Chem. Soc., Div. Fuel Chem. 2005, 50(2).**

Plasmas of certain catalysts such as K^+, Sr^+, and Ar^+ mixed with hydrogen were studied for evidence of a novel energetic reaction. These hydrogen plasmas called resonant transfer- or rt-plasmas were observed

to form at low temperatures (e.g. $\approx 10^3\ K$) and an extraordinary low field strengths of about 1-2 V/cm. Time-dependent line broadening of the H Balmer α line was observed corresponding to extraordinarily fast H (25 eV). Intense hydrogen Lyman emission, a stationary inverted Lyman population, excessive afterglow duration, highly energetic hydrogen atoms, characteristic alkali-ion emission due to catalysis, predicted novel spectral lines, and the measurement of a power beyond any conventional chemistry were also observed. Using a number of spectroscopic and analytical techniques, the reaction products were identified as atoms with energies that are an extension of the Rydberg series to lower states as well as the corresponding molecules and hydride ions. The results show the feasibility of this highly exothermic reaction as a new energy source.

25. **R. Mills, W. Good, A. Voigt, Jinquan Dong, "Minimum Heat of Formation of Potassium Iodo Hydride", Int. J. Hydrogen Energy, Vol. 26, No. 11, Oct., (2001), pp. 1199-1208.**

It was previously reported [R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.] that a novel inorganic hydride compound KHI which comprised a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and potassium iodide. Potassium iodo hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy, ^1H and ^{39}K nuclear magnetic resonance spectroscopy, Fourier transform infrared spectroscopy, electrospray ionization time of flight mass spectroscopy, liquid chromatography/mass spectroscopy, thermal decomposition with analysis by gas chromatography, and mass spectroscopy, and elemental analysis. We report measurements of heats of formation of KHI by differential scanning calorimetry (DSC). With reactant KI present, potassium metal catalyst and atomic hydrogen were produced by decomposition of KH at an extremely slow rate under a helium atmosphere to increase the amount of atomic hydrogen by slowing the rate of molecular hydrogen formation. Since not all of the starting materials reacted, the observed minimum heats of formation were over $-2000\ kJ/mole\ H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8\ kJ/mole\ H_2$.

Section 39

Examiner Souw erroneously asserts on page 5 of his Appendix that:

(b) Applicant's XPS line anomaly has been identified by an independent third party as an impurity line: it <u>disappeared after surface cleaning</u> [3]. This refutation has been recited in the previous Appendix, but failed to be

addressed in Applicant's response. Therefore, Applicant's insistence of this line of being a "hydrino" line remains unpersuasive on both experimental and theoretical grounds.

The "cleaning" was ion sputtering to remove contamination due to handling the sample, if any. No contamination was noted by comparing the before and after results. From paper #68:

ToF-SIMS Characterization

The commercial silicon wafer, HF cleaned silicon wafer, and $\alpha - SiH$ coated nickel foil samples were characterized using Physical Electronics TRIFT ToF-SIMS instrument. The primary ion source was a pulsed $^{69}Ga^+$ liquid metal source operated at 15 keV [32-33]. The secondary ions were exacted by a ± 3 keV (according to the mode) voltage. Three electrostatic analyzers (Triple-Focusing-Time-of-Flight) deflect them in order to compensate for the initial energy dispersion of ions of the same mass. The 400 pA dc current was pulsed at a 5 kHz repetition rate with a 7 ns pulse width. The analyzed area was $60\,\mu m$ x $60\,\mu m$ and the mass range was 0-1000 AMU. The total ion dose was $7\,X10^{11}$ $ions/cm^2$, ensuring static conditions. Charge compensation was performed with a pulsed electron gun operated at 20 eV electron energy. In order to remove surface contaminants and expose a fresh surface for analysis, the samples were sputter-cleaned for 30 s using a $80\,\mu m$ x $80\,\mu m$ raster, with 600 pA current, resulting in a total ion dose of 10^{15} $ions/cm^2$. Three different regions on each sample of $60\,\mu m$ x $60\,\mu m$ were analyzed. The positive and negative SIMS spectra were acquired. Representative post sputtering data is reported. The ToF-SIMS data were treated using 'cadence' software (Physical Electronics), which calculates the mass calibration from well-defined reference peaks.

The hydride was not removed with sputtering which showed that the sample was in fact hydride. It also confirmed the source of the novel XPS peaks was a hydride film.

XPS and TOF-SIMS can identify all of the known elements in all of the oxidation states known for the particular element. There is no element or oxidation state of an element called "impurity". Since the peaks could not be assigned to any known element in any oxidation state as shown by the survey scan, Figure 12 of paper 61, compared to the XPS data of the known elements and their oxidation states (See Ref. 35 of paper 61-C. D. Wagner, W. M. Riggs, L. E. Davis, J. F. Moulder, G. E. Mulilenberg (Editor), *Handbook of X-ray Photoelectron Spectroscopy*, Perkin-Elmer Corp., Eden Prairie, Minnesota, (1997), it must be to an <u>element with a new binding energy</u>. The coating is

hydride as shown by TOF-SIMS that is orders of magnitude more stable than ordinary hydride as shown by TOF-SIMS and XPS, and the XPS peaks matched those predicted for hydrino hydride. Thus, the assignment to lower-energy hydrogen is well supported by the data; whereas, an alternative assignment is not.

From paper # 61:

The 0-70 eV binding energy region of a nickel foil coated with an $\alpha - SiH$ film and exposed to air for 20 min. before XPS analysis is shown in Figure 21. By comparison of the $\alpha - SiH$ sample to the controls, novel XPS peaks were identified at 11, 43, and 55 eV. These peaks do not correspond to any of the primary elements, silicon, carbon, or oxygen, shown in the survey scan in Figure 12, wherein the peaks of these elements are given by Wagner et al. [35]. Hydrogen is the only element which does not have primary element peaks; thus, it is the only candidate to produce the novel peaks and correspond to the H content of the SiH coatings. These peaks closely matched hydrides formed by the catalytic reaction of He^{+} with atomic hydrogen and subsequent reactions to form highly stable silicon hydride products $\alpha - SiH$ that were discussed previously [31].

From paper 45:

The energetic plasma reaction was used to synthesize a potentially commercially important product. Nickel substrates were coated by the reaction product of a low pressure microwave discharge plasma of SiH_4 (2.5%)/He (96.6%)/H_2 (0.9%). The ToF-SIMS identified the coatings as hydride by the large SiH^{+} peak in the positive spectrum and the dominant H^{-} in the negative spectrum. XPS identified the H content of the SiH coatings as hydride ions, $H^{-}(1/4)$, $H^{-}(1/9)$, and $H^{-}(1/11)$ corresponding to peaks at 11, 43, and 55 eV, respectively. The novel hydride ions are proposed to form by the catalytic reaction of He^{+} with atomic hydrogen and subsequent autocatalytic reactions of $H(1/p)$ to form highly stable silicon hydride products $SiH(1/p)$ (p is an integer greater than one in Eqs. (4-5)). The SiH coating was amorphous as indicated by the shape of the Si $2p$ peak and was remarkably stable to air exposure. After a 48 hour exposure to air, essentially no oxygen was observed as evidence by the negligible O $1s$ peak at 531 eV and absence of any SiO_x Si $2p$ peak in the region of 102-104 eV. The highly stable amorphous silicon hydride coating may advance the production of integrated circuits and microdevices by resisting the oxygen passivation of the surface and

possibly altering the dielectric constant and band gap to increase device performance.

Section 40

Examiner Souw further mischaracterizes Applicant's scientific evidence on page 5 of the Appendix:

(c) Pg.36-37

The experiment of Marchese et al. cited by Applicant has proven by hard evidence that the reaction suggested by Applicant is not more efficient than conventional reaction (A. Marchese's **Final Report [1] pg.33, lines 1-2 below Fig.29)**.

The Examiner has taken the data on a nozzle design out of context. Marchese et al. independently replicated Applicant's results and were not paid (a standard set by the Examiner (see Section 12 of the Attachment):

44. **A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002, http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese. pdf.**

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel performed verification studies as visiting researchers at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of extraordinarily broadened atomic hydrogen lines, population inversion, lower-energy hydrogen lines, and excess power measured by water bath calorimetry were replicated. The application of the energetic hydrogen to propulsion was studied.

Specifically, the data supporting hydrinos was replicated. See

i.) BlackLight Process Theory (pp. 10-12) which gives the theoretical energy levels for hydrinos and the catalytic reaction to form hydrinos,

ii.) Unique Hydrogen Line Broadening in Low Pressure Microwave Water Plasmas (pp. 25-27, particularly Fig. 21) which shows that in the same microwave cavity driven at the same power, the temperature of the hydrogen atoms in the microwave plasma where the hydrino reaction was active was 50 times that of the control based on the spectroscopic line widths,

iii.) Inversion of the Line Intensities in Hydrogen Balmer Series (pp. 27-28, particularly Fig. 22) which shows for the first time in 40 years of intensive worldwide research that atomic hydrogen population inversion

was achieved in a steady state plasma and supports the high power released from the reaction of hydrogen to form hydrinos,

iv.) Novel Vacuum Ultraviolet (VUV) Vibration Spectra of Hydrogen Mixture Plasmas (pp. 28-29, particularly Fig. 23) which shows a novel vibrational series of lines in a helium-hydrogen plasmas at energies higher than any known vibrational series and it identically matches the theoretical prediction of 2 squared times the corresponding vibration of the ordinary hydrogen species, and

v.) Water Bath Calorimetry Experiments Showing Increased Heat Generation (pp. 29-30, particularly Fig. 25) that shows that with exactly the same system and same input power, the heating of the water reservoir absolutely measured to 1% accuracy was equivalent to 55 to 62 W with the catalyst-hydrogen mixture compared to 40 W in the control without the possibility of the reaction to form hydrinos.

The energetic hydrogen measured in rt-plasmas taught by Applicant was applied to a nozzle design. The context of the statement is evident: "As shown in Fig. 29b, the measured C* values are on the same order as those of chemical rocket propulsion, which is reasonable for the proof of concept test."

Section 41

Examiner Souw further argues on page 5 of the Appendix:

In addition, EarthTech, which is an independent research company, failed to confirm Applicant's claimed result. EarthTech's effort to replicate Applicant's claim is documented at <http://www.earthtech.org/experiments/blp/prelim.html> [2a], and the negative finding at <http://www.earthtech.org/experiments/mills/mills1.html> [2b]. Based on these two negative results alone among others [2a, 2b], Applicant's arguments on pg.36-37 must be deemed unpersuasive. Consequently, Applicant's claim of having invented a novel, more efficient chemical process, is deemed incredible.

For reasons stated above, publications from A.J. Marchese relating to "hydrino" are not counted as support, but instead, as a refutation of Applicant's claim, in support of the Examiner's. These include "evidence" nos.16 and 44.

The EarthTech issue and the fact that many top laboratories that were not direct competitors of Applicant replicated the very same experiments are discussed in Section 29 above. The two results cited by the Examiner were not negative, as discussed in

Sections 21-22 of the Attachment. Marchese replicated many aspect's of Applicant's Invention as stated in his report and discussed in Sections 29 and 40 above. Examiner Souw's refusal to acknowledge these facts is further evidence of his blatent bias against Applicant.

Section 42

Examiner Souw incorrectly argues on pages 6-7 of his Appendix that:

(d) Regarding pg. 137-138 of Applicant's main 161 page Response dated 08/11/2004, that the 0.16 nm line broadening cited by the Examiner Souw is allegedly *"negligible to the >10 eV hot H found in Applicant's rt-plasmas"*, and further, on pg. 142 of 161, *"absolutely negligible compared to the >100 eV hot H found in rt-plasmas"*, must be dismissed for the following reasons:

(d. 1) The 0.16 nm broadening (equivalent to $3,7 \ cm^{-1}$) is cited by Examiner Souw to be compared with the 0.27 nm broadening measured by Applicant, but not to *"10 eV or 100 eV hot HI"* as alleged by Applicant. This purpose is unambiguously clear in this reproduced passage from the Examiner's Appendix attached to the previous action:

"Secondly, and most importantly, anomalous hydrogen line broadening is not at all an evidence for the existence of hydrino, because it is well known in the art that such a broadening may be caused by many other conventional mechanisms, such as microwave plasm3a effects, the latter having not been considered by Applicant. Instead, such an effect has been so far ignored or dismissed by Applicant without any valid reason. The measured excessive line-width shown in Applicant 's Fig. 6 of ref. [6], i.e., 0.27nm. is about the same magnitude as what is measured by other authors, e.g., ref. [5] cited in the May 7 Appendix, here reproduced in Fig. 1 below.

As shown in Fig. [1], the anomalous line width of **0.16 nmn**, measured in a microwave discharge similar to Applicant 's under the same gas mixture and pressure range, is about 10 *times the Doppler width, and has been attributed to microwave plasma effects." (ref [5] Luggenhoelscher et al.; Ref [6] Mills et a!.)*

Obviously, Applicant has misrepresented the original dispute over Applicant's 0.27 linewidth by changing or shifting the original subject matter into something else (translational kinetic energy; see below).

Examiner Souw is not only confused, but is not internally consistent even with the views expressed in the same Office Action. As reported in Section 18 of the Attachment, the Committee states that

> Applicant has also seriously misinterpreted the Examiner's plasma arguments by incorrectly comparing the Examiner's cited line broadening of 0.16 nm in the prior art with >100 eV hot H found in applicant's rt-plasmas. Due to applicant's misinterpretation of the Examiner's statements, the data of the prior art and his own data, he incorrectly states that the line broadening observed in Luggenhoelscher is off by six orders of magnitude as compared to applicant's observed line widths on page 169 of the present response. The applicant's misinterpretation of the Examiner's remarks on his plasma data, those of the cited prior art, and his own data are detailed on pages 6-12 of the attached appendix (Part I, section B (subsections d.1-d.6, e, and f)).

This is in direct contradiction to the position espoused in a previous Office Action, wherein the opposite is stated:

> Applicant points out that the reasons for Balmer line broadening are discussed in many articles, and that the observed broadening is in excess in what can be expected from known sources thereof. This is not persuasive because broadening may be caused by various means including those taken into account by applicant, and those not taken into account. In the enclosed article by Luggenholscher, et. al., broadening equivalent to that found by applicant, shown in figure 1, is accounted for by conventionally known explanations such as the Stark effect. The enclosed article by Luque et. al. accounts for Halpha broadening using two Lorentzian mechanisms (Stark and Van der Waals) and two Gaussian mechanisms (Doppler and instrumental).

Then in this section, the Examiner returns to the Committee's original position even in light of the strongly emphasized paper of Jovicevic et al. In S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004), the authors state that it was impossible to measure any microwave field effect or Stark effect and it would require a resolution of better than about 0.02 nm (See P. 28 line 14).

The broadening reported in the Examiner's reference URL: http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf is 0.37 cm-1 with no field and 3.7 cm-1 with the application of the microwave field. The energies corresponding to these widths are $4.5 \ X10^{-5} \ eV$ and $4.5 \ X10^{-4} \ eV$, respectively, which is absolutely negligible compared to the >10 eV hot H found in rt-plasmas. The microwave field can not

explain Applicant's results. The Examiner's alternative explanation is off by <u>six orders of magnitude</u>.

The Examiner is grossly in error of the relative difference between the results in Applicant's paper #49 and those of the Examiner's Luque et al. paper. The broadening reported in the Examiner's reference URL: http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf is 0.37 cm-1 with no field and 3.7 cm-1 with the application of the microwave field. The energies corresponding to these widths are $4.5 \ X10^{-5} \ eV$ and $4.5 \ X10^{-4} \ eV$, respectively, which is absolutely negligible compared to the >10 eV hot H found in rt-plasmas. The microwave field can not explain Applicant's results. The microwave field can not explain Applicant's results of extraordinary broadening observed in these cells with catalysts present and not observed under identical conditions with no catalyst present.

The Examiner should take better care to read the units of Fig. [1] that are in cm-1, **NOT nm**. The difference is about **SIX ORDERS MAGNITUDE in H energy**.

The Examiner exhibits the same pattern of internal inconsistency with his argument of the basis of SQM. SQM is not a theory based on physical laws as stated by the Examiner. It has <u>nothing</u> to do with physics. It is purely mathematical and relies on metaphysical beliefs that reality is created by measurement, that virtual particles exist in every point in space, that extra compactified dimensions exist that can not be observed, that spooky actions at distance are the norm, that infinities exist, but can be renormalized, etc. This is the truth of the Examiner's position that he falsely and unfairly projects onto Applicant when Applicant has rigorously derived his results from Maxwell's' equations, Newton's laws and special relativity. As is common practice by quantum aficionados, the Examiner grossly distorts and hypes the capabilities of SQM. Applicant's results are closed-form equations with fundamental constants only. The results are predictive in that the solution for any given parameter is predictive of the conjugate parameters. There is not an single example in SQM where this is the case. Furthermore, if SQM were required to adhere to physical laws and internal consistency, there is not even a single example of a successful prediction.

Section 43

On page 7 of the Souw Appendix, the Examiner presents yet another

nonsensical argument:

> (d.2) By reciting 10 eV on pg. 138, but 100 eV on pg.142, not only has
> Applicant compared to a differently related quantity (presumed
> translational kinetic energy; see next), but also has Applicant failed to
> particularly point out the subject matter he wants to raise (10 eV or 100
> eV?).

The Examiner is obviously confused. Doppler broadening is due to kinetic

energy as given in Applicant's papers, the papers cited by the Examiner:

> S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl.
> Phys. 95, 24 (2004).
> N. Cvetanovic, M. M. Kuraica and N. Konjevic, J. Appl. Phys. 97, 33302
> (2005).

and many others:

1. M. Kuraica, N. Konjevic, "Line shapes of atomic hydrogen in a plane-cathode abnormal glow discharge", Physical Review A, Volume 46, No. 7, October (1992), pp. 4429-4432.
2. M. Kuraica, N. Konjevic, M. Platisa and D. Pantelic, *Spectrochimica Acta* Vol. 47, 1173 (1992).
3. I. R. Videnovic, N. Konjevic, M. M. Kuraica, "Spectroscopic investigations of a cathode fall region of the Grimm-type glow discharge", Spectrochimica Acta, Part B, Vol. 51, (1996), pp. 1707-1731.
4. S. Alexiou, E. Leboucher-Dalimier, "Hydrogen Balmer-α in dense plasmas", Phys, Rev. E, Vol. 60, No. 3, (1999), pp. 3436-3438.
5. S. Djurovic, J. R. Roberts, "Hydrogen Balmer alpha line shapes for hydrogen-argon mixtures in a low-pressure rf discharge", J. Appl. Phys., Vol. 74, No. 11, (1993), pp. 6558-6565.
6. S. B. Radovanov, K. Dzierzega, J. R. Roberts, J. K. Olthoff, Time-resolved Balmer-alpha emission from fast hydrogen atoms in low pressure, radio-frequency discharges in hydrogen", Appl. Phys. Lett., Vol. 66, No. 20, (1995), pp. 2637-2639.
7. S. B. Radovanov, J. K. Olthoff, R. J. Van Brunt, S. Djurovic, "Ion kinetic-energy distributions and Balmer-alpha (H_α) excitation in $Ar - H_2$ radio-frequency discharges", J. Appl. Phys., Vol. 78, No. 2, (1995), pp. 746-757.
8. R. L. Mills, P. Ray, "Substantial Changes in the Characteristics of a Microwave Plasma Due to Combining Argon and Hydrogen", New Journal of Physics, www.njp.org, Vol. 4, (2002), pp. 22.1-22.17.
9. R. L. Mills, P. Ray, B. Dhandapani, R. M. Mayo, J. He, "Comparison of

Excessive Balmer α Line Broadening of Glow Discharge and Microwave Hydrogen Plasmas with Certain Catalysts", J. of Applied Physics, Vol. 92, No. 12, (2002), pp. 7008-7022.

10. R. Mills and M. Nansteel, P. Ray, "Argon-Hydrogen-Strontium Discharge Light Source", IEEE Transactions on Plasma Science, Vol. 30, No. 2, (2002), pp. 639-653.

11. R. Mills, M. Nansteel, and P. Ray, "Excessively Bright Hydrogen-Strontium Plasma Light Source Due to Energy Resonance of Strontium with Hydrogen", J. of Plasma Physics, Vol. 69, (2003), pp. 131-158.

12. R. Mills and M. Nansteel, P. Ray, "Bright Hydrogen-Light Source due to a Resonant Energy Transfer with Strontium and Argon Ions", New Journal of Physics, Vol. 4, (2002), pp. 70.1-70.28.

13. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355.

14. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.

15. R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.

16. R. Mills, P. Ray, R. M. Mayo, "CW H I Laser Based on a Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Group I Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 2, (2003), pp. 236-247.

17. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Catalysts", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1504-1509.

Section 44

Examiner Souw continues his misguided arguments on page 7 of the Appendix, stating that:

(d.3) Applicant is silent about writing the 3.7 cm^{-1} linewidth in wavelength unit. The alternative expression, $\delta\lambda$= 0.16 nm, obviates Applicant's $\delta\lambda$=0.27 nm, <u>without ever postulating or presuming any Doppler effect</u>. Instead, Applicant chose to express the observed line width in [eV] unit, which is simply obtained by multiplying the linewidth originally in units of wavenumber (3.7 cm^{-1}) with c=3·0^{10} cm/sec, thus resulting in $\delta\lambda$ 100 GHz, and further multiplying with the Planck constant h=4x10^{-15} eV?sec to give approximately h?äí?0.45 meV. While the expression hí bears the physical

meaning of a kinetic energy of an <u>oscillating</u> electron having a frequency í, the new quantity h?äí <u>would</u> mean a <u>blur</u> or <u>spread</u> in the oscillation kinetic energy of a radiating electron <u>transition dipole</u>, the latter being a QM entity without classical correspondence (=<ø$_2$??|$\mathbf{a \cdot D}$ |ø$_1$>; see original Appendix, sect.3/pg.7). This blur may be due to Stark effect or microwave effect or something else that does not need to be further specified at this point. However, Applicant proceeds to <u>improperly</u> compare this <u>line width</u> with a hypothetical 10-100 eV <u>translational kinetic energy</u>, which is not just in a different unit, but of a totally different nature involving a sequence of presumptions that is not only controversial, but also disputable, as will be described next. Thus, Applicant is comparing "apples" to "oranges".

Again, the Examiner is deeply confused. The standard unit for reporting line broadening in the plasmas of interest in this case are electron volts (eV). See the following papers including those cited by the Examiner:

S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004).
N. Cvetanovic, M. M. Kuraica and N. Konjevic, J. Appl. Phys. 97, 33302 (2005).

and many others:

1. M. Kuraica, N. Konjevic, "Line shapes of atomic hydrogen in a plane-cathode abnormal glow discharge", Physical Review A, Volume 46, No. 7, October (1992), pp. 4429-4432.
2. M. Kuraica, N. Konjevic, M. Platisa and D. Pantelic, *Spectrochimica Acta* Vol. 47, 1173 (1992).
3. I. R. Videnovic, N. Konjevic, M. M. Kuraica, "Spectroscopic investigations of a cathode fall region of the Grimm-type glow discharge", Spectrochimica Acta, Part B, Vol. 51, (1996), pp. 1707-1731.
4. S. Alexiou, E. Leboucher-Dalimier, "Hydrogen Balmer-α in dense plasmas", Phys, Rev. E, Vol. 60, No. 3, (1999), pp. 3436-3438.
5. S. Djurovic, J. R. Roberts, "Hydrogen Balmer alpha line shapes for hydrogen-argon mixtures in a low-pressure rf discharge", J. Appl. Phys., Vol. 74, No. 11, (1993), pp. 6558-6565.
6. S. B. Radovanov, K. Dzierzega, J. R. Roberts, J. K. Olthoff, Time-resolved Balmer-alpha emission from fast hydrogen atoms in low pressure, radio-frequency discharges in hydrogen", Appl. Phys. Lett., Vol. 66, No. 20, (1995), pp. 2637-2639.
7. S. B. Radovanov, J. K. Olthoff, R. J. Van Brunt, S. Djurovic, "Ion kinetic-energy distributions and Balmer-alpha (H_α) excitation in $Ar - H_2$ radio-frequency discharges", J. Appl. Phys., Vol. 78, No. 2, (1995), pp. 746-

757.

8. R. L. Mills, P. Ray, "Substantial Changes in the Characteristics of a Microwave Plasma Due to Combining Argon and Hydrogen", New Journal of Physics, www.njp.org, Vol. 4, (2002), pp. 22.1-22.17.

9. R. L. Mills, P. Ray, B. Dhandapani, R. M. Mayo, J. He, "Comparison of Excessive Balmer α Line Broadening of Glow Discharge and Microwave Hydrogen Plasmas with Certain Catalysts", J. of Applied Physics, Vol. 92, No. 12, (2002), pp. 7008-7022.

10. R. Mills and M. Nansteel, P. Ray, "Argon-Hydrogen-Strontium Discharge Light Source", IEEE Transactions on Plasma Science, Vol. 30, No. 2, (2002), pp. 639-653.

11. R. Mills, M. Nansteel, and P. Ray, "Excessively Bright Hydrogen-Strontium Plasma Light Source Due to Energy Resonance of Strontium with Hydrogen", J. of Plasma Physics, Vol. 69, (2003), pp. 131-158.

12. R. Mills and M. Nansteel, P. Ray, "Bright Hydrogen-Light Source due to a Resonant Energy Transfer with Strontium and Argon Ions", New Journal of Physics, Vol. 4, (2002), pp. 70.1-70.28.

13. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355.

14. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.

15. R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.

16. R. Mills, P. Ray, R. M. Mayo, "CW H I Laser Based on a Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Group I Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 2, (2003), pp. 236-247.

17. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Catalysts", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1504-1509.

The Examiner is also grossly in error of the relative difference between the results in Applicant's paper #49 and those of the Examiner's Luque et al. paper. The broadening reported in the Examiner's reference URL:

http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf is 0.37 cm-1 with no field and 3.7 cm-1 with the application of the microwave field. The energies corresponding to these widths are 4.5×10^{-5} eV and 4.5×10^{-4} eV, respectively, which is absolutely negligible

compared to the >10 eV hot H found in rt-plasmas. The microwave field can not explain Applicant's results. The microwave field can not explain Applicant's results of extraordinary broadening observed in these cells with catalysts present and not observed under identical conditions with no catalyst present.

The Examiner should take better care to read the units of Fig. [1] that are in cm-1, **NOT nm**. The difference is about **SIX ORDERS MAGNITUDE in H energy**.

Specially, the width reported in energy is 3.7 cm-1 corresponding to 4.5 meV. The method to calculate the energetic hydrogen atom energies from the width of the 656.3 nm Balmer α line is given by Videnovic et al. [3. I. R. Videnovic, N. Konjevic, M. M. Kuraica, "Spectroscopic investigations of a cathode fall region of the Grimm-type glow discharge", Spectrochimica Acta, Part B, Vol. 51, (1996), pp. 1707-1731]. The full half-width $\Delta\lambda_G$ of each Gaussian results from the Doppler ($\Delta\lambda_D$) and instrumental ($\Delta\lambda_I$) half-widths:

$$\Delta\lambda_G = \sqrt{\Delta\lambda_D^2 + \Delta\lambda_I^2} \tag{1}$$

$\Delta\lambda_I$ for these experiments was 0.05 nm. The temperature was calculated from the Doppler half-width using the formula:

$$\Delta\lambda_D = 7.16 X 10^{-7}\lambda_0\left(\frac{T}{\mu}\right)^{1/2} \tag{2}$$

where λ_0 is the line wavelength, T is the temperature in K ($1\ eV = 11,605\ K$), and μ is the molecular weight (=1 for hydrogen).

Thus, the line width in nm corresponding to an energy of 3.7 cm-1 (4.5 meV) is given by

$$\Delta\lambda_D = 7.16 X 10^{-7}(656nm)\left(\frac{4.5X10^{-3}(11,605K/eV)}{1}\right)^{1/2} \tag{3}$$

$$0.001\ nm$$

which is absolutely trivial.

The carelessness of the Examiner and the fact that he is waffling is shown in Section 42 above. This is obvious given that the Examiner went from arguing no broadening then to his original position of broadening with a trivial explanation of microwave field broadening even in light of the strongly emphasized paper of Jovicevic

et al. In S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004), the authors state that it was impossible to measure any microwave field effect or Stark effect and it would require a resolution of better than about 0.02 nm (See P. 28 line 14). Even more disturbing is that the Examiner has based a major portion of his rejection of a subject matter over which he is obviously confused to the point that he fails to distinguish between units of energy versus units of wavelength.

The broadening is unequivocally Doppler broadening as discussed in References #49 and # 37. The microwave-field broadening cited in Examiner's Luque et al paper is <u>six orders of magnitude</u> too low to account for the broadening reported by Applicant (e.g. Ref. #49). In fact, the point of the paper by Luque et al. was the very technically difficult Doppler-free two-photon excitation to show the microwave effect which can not otherwise be observed since it is overwhelmed by the Doppler broadening as also pointed out in the strongly emphasized paper of Jovicevic et al (S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004)).

In addition, the magnitude of the broadening varies as expected based on the particular catalyst and the duration of the reaction with more energetic transitions occurring with time as discussed in

51. **J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted.**

<u>J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico</u>, performed verification studies of line broadening in catalysis plasmas. This is the third in a series of papers by our team on apparently anomalous Balmer series line broadening in hydrogen containing RF generated, low pressure (< 600 mTorr) plasmas. In this paper the selective broadening of the atomic hydrogen lines in pure H2 and Ar/H2 mixtures in a large "GEC" cell (36 cm length X 14 cm ID) was mapped as a function of position, H2/Ar ratio, time, power, and pressure. Several observations regarding the selective line broadening were particularly notable as they are unanticipated on the basis of earlier models. First, the anomalous broadening of the Balmer lines was found to exist throughout the plasma, and not just in the region between the electrodes. Second, the broadening was consistently a complex function of the operating parameters particularly gas composition (highest in pure H2) position, power and pressure. Clearly not anticipated by earlier models were the

findings that under some conditions the highest concentration of "hot" (>10 eV) hydrogen was found at the entry end, and not in the high field region between the electrodes and that in other conditions, the hottest H was at the (exit) pump (also grounded electrode) end. Third, excitation and electron temperatures were less than one eV in all regions of the plasma not directly adjacent (>1mm) to the electrodes, providing additional evidence that the energy for broadening, contrary to standard models, is not obtained from the field. Fourth, in contrast to our earlier studies of hydrogen/helium and water plasmas, we found that in some conditions 98% of the atomic hydrogen was in the "hot" state throughout the GEC cell. Virtually every operating parameter studied impacted the character of the hot H atom population, and clearly second and third order effects exist, indicating a need for experimental design. Some non-field mechanisms for generating hot hydrogen atoms, specifically those suggested by Mills' CQM model, are outlined.

Section 45

Examiner Souw commits further errors in his analysis on page 8 of the Appendix:

(d.4) Applicant (mis)interpret the observed linewidth as a Doppler width, for which there is no justification, but --at most-- only a presumption or tentative suggestion. To recapitulate, Applicant came to the 10-100 eV number by firstly presuming the observed linewidth as being entirely due to Doppler effect. Secondly, Applicant then converts the frequency shift (100 GHz) corresponding to the observed line broadening into atomic velocity, then finally multiplying the square of this velocity by the atomic mass to derive the suggested 10-100 eV translational kinetic energy (which is totally of different nature than the 0.45 meV blur or spread of unknown origin in the oscillation kinetic energy of a radiating electron transition dipole, as recited above). Such a derivation is based on a sequence of presumptions that may be partially or even entirely incorrect. Although Doppler effect is omnipresent, there is no justification for assuming the observed line broadening as being entirely due to the Doppler effect. The factual evidence only shows a 0.16 nm line width as observed by Luggenhoelscher, comparable to a 0.27 nm claimed by Applicant. There is no evidence that Applicant's 0.27 nm can be correlated to a translational kinetic energy of ">l0 eV" or ">100 eV", or whatsoever, by presuming the linewidth were entirely caused by "hot H", as postulated by Applicant.

The broadening is unequivocally Doppler broadening as stated in the Examiner's' cited paper, N. Cvetanovic, M. M. Kuraica and N. Konjevic, J. Appl. Phys. 97, 33302 (2005), as well as those given in Section 43 above. The Examiner is

oblivious to the body of evidence that he even cites that identifies the observations of

line broadening as due to hot H with energies in the range of 10-300 eV.

The Examiner cites Applicant's paper:

49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive
    Balmer α Line Broadening of Inductively and Capacitively Coupled
    RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain
    Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 3,
    (2003), pp. 338-355.

The introduction is copied below to help educate the Examiner on the proper

background in this field on which he so heavily relies for his rejections:

I. INTRODUCTION

Glow discharge devices have been developed over decades as
light sources, ionization sources for mass spectroscopy, excitation
sources for optical spectroscopy, and sources of ions for surface etching
and chemistry [1-3]. A Grimm-type glow discharge is a well established
excitation source for the analysis of conducting solid samples by optical
emission spectroscopy [4-6]. But, only in the last decade has extensive
spectroscopic characterization been conducted that has led to some
puzzling observations. For example, M. Kuraica and N. Konjevic [7],
Videnovic et al. [8], and others [9-12] have characterized mixed hydrogen-
argon plasmas by determining the excited hydrogen atom energies from
measurements of the line broadening of one or more of the Balmer α, β,
and γ lines of atomic hydrogen at 656.28, 486.13, and 434.05 nm,
respectively. They found that the Balmer lines were extremely broadened
and explained the phenomenon primarily in terms of Doppler broadening
due to the acceleration of charges such as H^+, H_2^+, and H_3^+ in the high
fields (e. g. over 10 kV/cm) present in the cathode fall region.

Djurovic and Roberts [10] recorded the spectral and spatial profiles
of Balmer α line emission from low pressure RF (13.56 MHz) discharges
in $H_2 + Ar$ mixtures in a direction normal to the electric field. The
introduction of Ar in a pure H_2 plasma increased the number of fast
neutral atoms as evidenced by the intensity of the broad component of a
two-component Doppler-broadened Balmer α line profile. Independent of
cell position or direction, the average energy of a wide profile component
was 23.8 eV for voltages above 100 V, and the average energy of a slow
component was 0.22 eV. The mechanism proposed by Djurovic and
Roberts is the production of fast H atoms from electric field accelerated
H_2^+. The explanation of the role of Ar in the production of a large number
of excited hydrogen atoms in the $n = 3$ state, as well as raising their
energy for a given pressure and applied RF voltage, is that collisions with

Ar in the plasma sheath region enhances the production of fast H_2 from accelerated H_2^+. The fast H_2 then undergoes dissociation to form fast H which may then be excited locally to the $n = 3$ state by a further collision with Ar. The local excitation is a requirement since the atomic lifetime of the hydrogen $n = 3$ state is approximately 10^{-8} s, and the average velocity of the hydrogen atoms is $< 10^5$ m/s. Thus, the distance traveled must be less that 0.001 m. A number of additional mechanisms have been proposed in order to explain the excessive Doppler broadening of the Balmer α line in argon-hydrogen DC or RF driven glow discharge plasmas all of which ultimately depend on electric field acceleration of hydrogen positive ions.

Hydrogen mixed with certain noble gases has also been observed to give unexpected hydrogen emission intensity. For example, based on its unusually intense emission, a neon-hydrogen microhollow cathode glow discharge has been proposed as a source of predominantly Lyman α radiation. Kurunczi, Shah, and Becker [13] observed intense emission of Lyman α and Lyman β radiation at 121.6 nm and 102.5 nm, respectively, from microhollow cathode discharges in high-pressure Ne (740 Torr) with the addition of a small amount of hydrogen (up to 3 Torr). With essentially no molecular emission observed, Kurunczi et al. attributed the anomalous Lyman α emission to the near-resonant energy transfer between the Ne_2^* excimer and H_2 which leads to formation of $H(n = 2)$ atoms, and attributed the Lyman β emission to the near-resonant energy transfer between excited Ne^* atoms (or vibrationally excited neon excimer molecules) and H_2 which leads to formation of $H(n = 3)$ atoms. Despite the emission characterization of this source, data is lacking about plasma parameters.

A new low-electric field plasma source has been developed that is based on a resonant energy transfer of an integer of 27.2 eV from atomic hydrogen to a catalyst capable of accepting the energy. It operates by incandescently heating a hydrogen dissociator and a catalyst to provide atomic hydrogen and gaseous catalyst, respectively, such that the catalyst reacts with the atomic hydrogen to produce a plasma called a resonant transfer (rt)-plasma. It was extraordinary, that intense vacuum ultraviolet (VUV) emission was observed [14-16] at low temperatures (e.g. $\approx 10^3$ K) from atomic hydrogen and certain atomized elements or certain gaseous ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV that comprise catalysts. The only pure elements that were observed to emit VUV were those wherein the ionization of t electrons from an atom to a continuum energy level is such that the sum of the ionization energies of the t electrons is approximately $m \cdot 27.2$ eV where t and m are each an integer. For example, K, Cs, Sr, Sr^+, and Rb^+ each ionize at integer multiples of the potential energy of atomic hydrogen and caused emission as predicted; whereas, the chemically similar atoms, Na, Mg, and Ba, do not ionize at integer

multiples of the potential energy of atomic hydrogen and caused no emission as predicted as well. The theory and balanced resonant energy transfer reactions have been given previously [14-15, 17] or are in press [16, 18].

In addition, Ar^+ and He^+ each ionize at an integer multiple of the potential energy of atomic hydrogen; thus, a discharge with one or more of Sr^+, Ar^+, and He^+ present with hydrogen was anticipated to form an rt-plasma. Mills and Nansteel [14] have reported that rt-plasmas formed with Sr^+ and Ar^+ catalysts at 1% of the theoretical or prior known voltage requirement with a light output per unit power input of up to 8600 times that of control standard light sources. Characteristic emission was observed from a continuum state of Ar^{2+} which confirmed the resonant nonradiative energy transfer of $27.2\ eV$ from atomic hydrogen Ar^+ [19]. Predicted emission lines were observed from helium-hydrogen [17-18, 20] as well as strontium-argon-hydrogen plasmas [19] that supported the rt-plasma mechanism.

He^+ ionizes at $54.417\ eV$ which is $2 \cdot 27.2\ eV$, and novel VUV emission lines were observed from microwave and glow discharges of helium with 2% hydrogen [20]. The observed energies were $q \cdot 13.6\ eV$ ($q = 1,2,3,4,6,7,8,9,\ or\ 11$) or these discrete energies less $21.2\ eV$ corresponding to inelastic scattering of these photons by helium atoms due to excitation of $He\ (1s^2)$ to $He\ (1s^1 2p^1)$. These lines can be explained by the resonant transfer of 2 times $27.2\ eV$, with He^+ to He^{2+} [20].

It was anticipated that glow, microwave, and RF discharges could each also provide atomic hydrogen and a catalyst to form an rt-plasma. In the present paper, we report studies to further characterize the plasma parameters observed in such rt-plasmas as well as the difference between rt-plasmas created by glow, microwave, and inductively and capacitively coupled RF discharge sources. The line broadening and intensity of the 656.3 nm Balmer α line was measured to determine the excited hydrogen atom energy and the H concentration in plasmas of hydrogen with a catalyst as well as plasmas comprising hydrogen with chemically similar controls that did not provide gaseous atoms or ions having electron ionization energies which are a multiple of $27.2\ eV$. In addition, the electron temperature T_e was measured on microwave and inductively coupled RF plasmas using the ratio of the intensity I of two visible noble gas lines in two quantum states that were close in wavelength such as the ratio $I(He\ 501.6\ nm\ line)/I(He\ 492.2\ nm\ line)$ and the ratio $I(Ar\ 377.03\ nm\ line)/I(Ar\ 420.06\ nm\ line)$ for plasmas having helium and argon, respectively, alone or as a mixture with hydrogen.

We report here, that anomalous line broadening of H_α was observed as predicted in specific rt-plasmas gas mixtures but not in others where the resonant transfer condition was not satisfied. Moreover, as discussed *supra*, a number of mechanisms have been proposed in order to explain the excessive Doppler broadening of the Balmer α line in

argon-hydrogen high voltage DC or RF driven glow discharge plasmas that are all ultimately based on acceleration in a high electric field. We show that the experimental evidence from several rt-plasma sources does not support such a mechanism. These are shown to be untenable based on additional data and based on our results with microwave plasmas where no strong applied electric field (e. g. over $10 \ kV/cm$) or cathode fall region is present. Moreover, we anticipate the observed results based on the rt-plasma mechanism.

Section 46

Examiner Souw's erroneous analysis continues with the following arguments on pages 8-9 of his Appendix:

> Thus, a correlation of the observed line broadening anomaly with hydrogen translational kinetic energy, or velocity, or Doppler effect, is NOT a FACT, but only a suggestion or preposition, as correctly stated by Kovacevic et a!. [6] by using the wording "probably" and "possible process", seeing that there are still other mechanisms also probable. As a matter of fact, the plasma sheath effect proposed by Kovacevic et al. in [6] sounds even much more plausible than Applicant's postulated hydrino. While it is not the job of the PTO to participate in a scientific debate, a plausibility consideration is here appropriate. Kovacevic's plasma sheath is more plausible, simply because plasma sheath is a well known fact [7] routinely observed by many other researchers in a large number of unrelated phenomena, as opposed to "hydrino", whose existence is unproven by any evidence, and even more, in violation of known laws of physics, while also being postulated under an incredibly large number of mathematical flaws and conceptual misunderstanding.

Again, the Examiner is obviously confused. The broadening is unequivocally Doppler as cited by many references in addition to those of Applicant. See:

S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004).
N. Cvetanovic, M. M. Kuraica and N. Konjevic, J. Appl. Phys. 97, 33302 (2005).

and many others:

1. M. Kuraica, N. Konjevic, "Line shapes of atomic hydrogen in a plane-cathode abnormal glow discharge", Physical Review A, Volume 46, No. 7, October (1992), pp. 4429-4432.
2. M. Kuraica, N. Konjevic, M. Platisa and D. Pantelic, *Spectrochimica*

Acta Vol. 47, 1173 (1992).

3. I. R. Videnovic, N. Konjevic, M. M. Kuraica, "Spectroscopic investigations of a cathode fall region of the Grimm-type glow discharge", Spectrochimica Acta, Part B, Vol. 51, (1996), pp. 1707-1731.

4. S. Alexiou, E. Leboucher-Dalimier, "Hydrogen Balmer-α in dense plasmas", Phys, Rev. E, Vol. 60, No. 3, (1999), pp. 3436-3438.

5. S. Djurovic, J. R. Roberts, "Hydrogen Balmer alpha line shapes for hydrogen-argon mixtures in a low-pressure rf discharge", J. Appl. Phys., Vol. 74, No. 11, (1993), pp. 6558-6565.

6. S. B. Radovanov, K. Dzierzega, J. R. Roberts, J. K. Olthoff, Time-resolved Balmer-alpha emission from fast hydrogen atoms in low pressure, radio-frequency discharges in hydrogen", Appl. Phys. Lett., Vol. 66, No. 20, (1995), pp. 2637-2639.

7. S. B. Radovanov, J. K. Olthoff, R. J. Van Brunt, S. Djurovic, "Ion kinetic-energy distributions and Balmer-alpha (H_α) excitation in $Ar - H_2$ radio-frequency discharges", J. Appl. Phys., Vol. 78, No. 2, (1995), pp. 746-757.

8. R. L. Mills, P. Ray, "Substantial Changes in the Characteristics of a Microwave Plasma Due to Combining Argon and Hydrogen", New Journal of Physics, www.njp.org, Vol. 4, (2002), pp. 22.1-22.17.

9. R. L. Mills, P. Ray, B. Dhandapani, R. M. Mayo, J. He, "Comparison of Excessive Balmer α Line Broadening of Glow Discharge and Microwave Hydrogen Plasmas with Certain Catalysts", J. of Applied Physics, Vol. 92, No. 12, (2002), pp. 7008-7022.

10. R. Mills and M. Nansteel, P. Ray, "Argon-Hydrogen-Strontium Discharge Light Source", IEEE Transactions on Plasma Science, Vol. 30, No. 2, (2002), pp. 639-653.

11. R. Mills, M. Nansteel, and P. Ray, "Excessively Bright Hydrogen-Strontium Plasma Light Source Due to Energy Resonance of Strontium with Hydrogen", J. of Plasma Physics, Vol. 69, (2003), pp. 131-158.

12. R. Mills and M. Nansteel, P. Ray, "Bright Hydrogen-Light Source due to a Resonant Energy Transfer with Strontium and Argon Ions", New Journal of Physics, Vol. 4, (2002), pp. 70.1-70.28.

13. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355.

14. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.

15. R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.

16. R. Mills, P. Ray, R. M. Mayo, "CW H I Laser Based on a Stationary
Inverted Lyman Population Formed from Incandescently Heated
Hydrogen Gas with Certain Group I Catalysts", IEEE Transactions on
Plasma Science, Vol. 31, No. 2, (2003), pp. 236-247.
17. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population Formed
from Incandescently Heated Hydrogen Gas with Certain Catalysts", J.
Phys. D, Applied Physics, Vol. 36, (2003), pp. 1504-1509.

Doppler broadening is due to kinetic energy as stated in those papers. What is argued by others is that the origin of the broadening is electric-field acceleration. Applicant has shown that this can not be the explanation since among other observations, the line broadening is found undiminished in regions of the cell where there is no measured electric field, the effect is independent of direction of observation with respect to the field, it is time dependent, is selective for H, only occurs in cells having Applicant's predicted catalysts to form hydrino, and occurs in cells with no or very low fields such as microwave plasmas and filament (rt-plasma) cells. These points and the supporting references appear in Section 19 of the Attachment and others above.

Furthermore, SQM violates physical laws; whereas, CQM is derived from those laws as pointed out below. The existence of hydrino is confirmed overwhelming by the experimental evidence, such as that summarized in Section 2 the Attachement and in Section 28 above.

Section 47

Examiner Souw further argues without merit on page 9 of the Appendix:

> Thus, while 0.16 nm and 0.27 nm are scientific facts, Applicant's "10 eV or 100 eV **hot H**" is *not* a scientific *fact*, since the relation to translational kinetic velocity or energy (Doppler effect) of the radiating atom is only presumed without valid evidence (see Kovacevic [6]). Valid as hard evidence would be, e.g., a Doppler-free laser spectroscopic measurement, such as what was done by the Examiner in previously cited Ref.[8]. This would indisputably separate the Doppler effect from the homogeneous line broadening, the latter including Stark effects and microwave effects. Without such a hard evidence, Applicant's claim of"10 *eV or 100 eV hot H*" remains a hypothesis. Furthermore, such a claim does not have any relevance to, let alone a justification for, the existence of "hydrino". It is thus concluded, Applicant's claim that the observed

anomalous hydrogen line broadening were due to "hydrino" remains
scientifically _incredible,_ justifying the previously applied § 101 and §
112/¶.1 claim rejections.

The broadening is unequivocally Doppler broadening as given in the references
cited in Section 46 above. The hydrino explanation is the only one consistent with all of
the data, as discussed above in Section 46, for example. For a specific independent
analysis, see:

51. **J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of
Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE
Transactions on Plasma Science, submitted.**
J. Phillips, Distinguished National Laboratory Professor at Los
Alamos National Laboratory and University of New Mexico, performed
verification studies of line broadening in catalysis plasmas. This is the
third in a series of papers by our team on apparently anomalous Balmer
series line broadening in hydrogen containing RF generated, low pressure
(< 600 mTorr) plasmas. In this paper the selective broadening of the
atomic hydrogen lines in pure H2 and Ar/H2 mixtures in a large "GEC" cell
(36 cm length X 14 cm ID) was mapped as a function of position, H2/Ar
ratio, time, power, and pressure. Several observations regarding the
selective line broadening were particularly notable as they are
unanticipated on the basis of earlier models. First, the anomalous
broadening of the Balmer lines was found to exist throughout the plasma,
and not just in the region between the electrodes. Second, the
broadening was consistently a complex function of the operating
parameters particularly gas composition (highest in pure H2) position,
power and pressure. Clearly not anticipated by earlier models were the
findings that under some conditions the highest concentration of "hot"
(>10 eV) hydrogen was found at the entry end, and not in the high field
region between the electrodes and that in other conditions, the hottest H
was at the (exit) pump (also grounded electrode) end. Third, excitation
and electron temperatures were less than one eV in all regions of the
plasma not directly adjacent (>1mm) to the electrodes, providing
additional evidence that the energy for broadening, contrary to standard
models, is not obtained from the field. Fourth, in contrast to our earlier
studies of hydrogen/helium and water plasmas, we found that in some
conditions 98% of the atomic hydrogen was in the "hot" state throughout
the GEC cell. Virtually every operating parameter studied impacted the
character of the hot H atom population, and clearly second and third order
effects exist, indicating a need for experimental design. Some non-field
mechanisms for generating hot hydrogen atoms, specifically those
suggested by Mills' CQM model, are outlined.

The line broadening result is consistent with at least 11 other conjugate parameters measured on Applicant's plasma reactors, as shown in Section 2 of the Attachment and in Section 28 above.

Section 48

On pages 9-10 of the Appendix, Examiner Souw further errs in stating that:

(d.5) Applicant's method of estimating the 10-100 eV kinetic energy will now be applied to the Examiner's 0.16 nm linewidth (measured as full width at half maximum, FWHM), showing the sequence of presumptions thereby made, without regards of the validity of Applicant's unverified Doppler presumption. Firstly, the linewidth 3.7 cm^{-1} or 0.16 nm is converted into atomic velocity <v> according to the well known Doppler-shift formula äë/ë=v/c, presuming firstly there is no other contributing effects, and secondly, that the homogenous linewidth is negligible. By taking account for a factor originating from the relationship between a presumed Maxwell-Boltzman velocity distribution and the definition of FWHM Doppler linewidth, one easily obtains a 1-dimensional average hydrogen translational linear velocity <v_z>. Presuming further that the velocity distribution is isotropic and 3-dimensional, this translational linear velocity corresponds to an average (3-dimensional) translational kinetic energy of KE=m<v^2>/2, where m is the mass of atomic hydrogen (=1.67·10^{-24} gm). Ready-to-use formulas that may be taken for the above estimates are, for example, äë/ë=äí/í=(1/c)??(8kT?ln2/m) [9] and KE=m<v^2>/2=3kT/2 [10], in terms of the temperature T as a redundant parameter. One of ordinary skill in the art easily obtains a translational kinetic energy of *KE=15.2 eV*, which properly corresponds to the 0.16 nm line width under the presumptions described above.

We see, this **15.2 eV** kinetic energy is very much comparable to Applicant's **10-100 eV**, just in the same manner as 0.16 nm is comparable to 0.27 nm. Thus, by writing a directly measured linewidth 3.7 cm^{-1} in an alternative unit, 0.45 meV (which itself does not make sense), and then comparing the latter with a hypothesized 10 eV translational kinetic energy, not only is Applicant making an improper comparison, but Applicant is also violating a conceptual fundament of physics, like comparing "apples" with "oranges".

As shown in Section 44 above, the 3.7 cm-1 corresponds to an energy of 4.5 meV. The Examiner does not calculate the Doppler energy correctly according to the following references:

S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004).
N. Cvetanovic, M. M. Kuraica and N. Konjevic, J. Appl. Phys. 97, 33302 (2005).

and many others:

1. M. Kuraica, N. Konjevic, "Line shapes of atomic hydrogen in a plane-cathode abnormal glow discharge", Physical Review A, Volume 46, No. 7, October (1992), pp. 4429-4432.
2. M. Kuraica, N. Konjevic, M. Platisa and D. Pantelic, Spectrochimica Acta Vol. 47, 1173 (1992).
3. I. R. Videnovic, N. Konjevic, M. M. Kuraica, "Spectroscopic investigations of a cathode fall region of the Grimm-type glow discharge", Spectrochimica Acta, Part B, Vol. 51, (1996), pp. 1707-1731.
4. S. Alexiou, E. Leboucher-Dalimier, "Hydrogen Balmer-α in dense plasmas", Phys, Rev. E, Vol. 60, No. 3, (1999), pp. 3436-3438.
5. S. Djurovic, J. R. Roberts, "Hydrogen Balmer alpha line shapes for hydrogen-argon mixtures in a low-pressure rf discharge", J. Appl. Phys., Vol. 74, No. 11, (1993), pp. 6558-6565.
6. S. B. Radovanov, K. Dzierzega, J. R. Roberts, J. K. Olthoff, Time-resolved Balmer-alpha emission from fast hydrogen atoms in low pressure, radio-frequency discharges in hydrogen", Appl. Phys. Lett., Vol. 66, No. 20, (1995), pp. 2637-2639.
7. S. B. Radovanov, J. K. Olthoff, R. J. Van Brunt, S. Djurovic, "Ion kinetic-energy distributions and Balmer-alpha (H_α) excitation in $Ar - H_2$ radio-frequency discharges", J. Appl. Phys., Vol. 78, No. 2, (1995), pp. 746-757.
8. R. L. Mills, P. Ray, "Substantial Changes in the Characteristics of a Microwave Plasma Due to Combining Argon and Hydrogen", New Journal of Physics, www.njp.org, Vol. 4, (2002), pp. 22.1-22.17.
9. R. L. Mills, P. Ray, B. Dhandapani, R. M. Mayo, J. He, "Comparison of Excessive Balmer α Line Broadening of Glow Discharge and Microwave Hydrogen Plasmas with Certain Catalysts", J. of Applied Physics, Vol. 92, No. 12, (2002), pp. 7008-7022.
10. R. Mills and M. Nansteel, P. Ray, "Argon-Hydrogen-Strontium Discharge Light Source", IEEE Transactions on Plasma Science, Vol. 30, No. 2, (2002), pp. 639-653.
11. R. Mills, M. Nansteel, and P. Ray, "Excessively Bright Hydrogen-Strontium Plasma Light Source Due to Energy Resonance of Strontium with Hydrogen", J. of Plasma Physics, Vol. 69, (2003), pp. 131-158.
12. R. Mills and M. Nansteel, P. Ray, "Bright Hydrogen-Light Source due

to a Resonant Energy Transfer with Strontium and Argon Ions", New Journal of Physics, Vol. 4, (2002), pp. 70.1-70.28.

13. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355.

14. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.

15. R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.

16. R. Mills, P. Ray, R. M. Mayo, "CW H I Laser Based on a Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Group I Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 2, (2003), pp. 236-247.

17. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Catalysts", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1504-1509.

Section 49

Examiner Souw further argues on pages 10-11 of the Appendix that:

(d.6) Applicant's lengthy discussion on various broadening mechanism conducted on pgs. 139-142 is well known in the art, and is not argued by the Examiner. Disputed is here the interpretation of the observed broadening as being due to atomic velocity, or translational kinetic energy, or Doppler effect. The latter is no more than a probable mechanism, as correctly stated by Kovacevic [6] by using the wording "probably" and "possible process". There are many other possibilities that would also explain the observed effect, e.g., the well known microwave effect proposed by other researchers, e.g., Luggenhoelscher, as cited previously. Applicant is totally silent about this microwave effects.

These statements are not true. The selective H broadening is unequivocally Doppler broadening as stated by scores of researchers over decades of study. Applicant has discovered the origin of the predicted effect in Applicant's rt-plasma cells as due to the energy released as hydrogen undergoes transitions to lower-energy states.

Section 50

Examiner Souw further asserts without basis on page 11 of his Appendix that:

(e) Applicant's statement on pg.139, lines 1-3, that *"Stark broadening of hydrogen lines can not be measured at low electron densities ..."*, is scientifically inaccurate. Stark broadening, or any homogeneous line broadening, such as due to microwave effects, can well be accurately measured (to 10^{-5} nm or even better), e.g., by means of Doppler-free Laser Spectroscopy, as demonstrated by the Examiner in his own work cited previously [8]. Such a measurement would have been scientifically acceptable as hard evidence for the Doppler effect (but not for "hydrino"), since the Doppler-free technique would be able to cancel out the Doppler effect, thereby measuring only the intrinsic/homogeneous broadening (e.g., natural broadening, Stark broadening, both static and dynamic, AC Stark effect, microwave effects, etc.).

These effects are negligible compared to the observed >0.1 nm Gaussian broadening corresponding to the Doppler effect.

From Ref. #49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355:

We have assumed that Doppler broadening due to thermal motion was the dominant source to the extent that other sources may be neglected. To justify this assumption, each source is now considered. In general, the experimental profile is a convolution of a Doppler profile, an instrumental profile, the natural (lifetime) profile, Stark profiles, Van der Waals profiles, a resonance profile, and fine structure. The instrumental half-width is measured to be $\pm 0.006 \, nm$. The natural half-width of the Balmer α line given by Djurovic and Roberts [10] is $1.4 \, X \, 10^{-4} \, nm$ which is negligible. The fine structure splitting is also negligible.

Stark broadening of hydrogen lines in plasmas can not be measured at low electron densities using conventional emission or absorption spectroscopy because it is hidden by Doppler broadening. In the case of the Lyman α line, the Stark width exceeds the Doppler width only at $n_e > 10^{17} \, cm^{-3}$ for temperatures of about $10^4 \, K$ [34]. Gigosos and Cardenoso [35] give the observed Balmer α Stark broadening for plasmas of hydrogen with helium or argon as a function of the electron temperature and density. For example, the Stark broadening of the Balmer α line recorded on a

$H + He^+$ plasma is only 0.033 nm with $T_e = 20,000$ K and $n_e = 1.4 \times 10^{14}$ cm^{-3}.

The relationship between the Stark broadening $\Delta\lambda_S$ of the Balmer β line in nm, the electron density n_e in m^{-3}, and the electron temperature T_e in K is

$$\log n_e = C_0 + C_1 \log(\Delta\lambda_S) + C_2 [\log(\Delta\lambda_S)]^2 + C_3 \log(T_e) \tag{5}$$

where $C_0 = 22.578$, $C_1 = 1.478$, $C_2 = -0.144$, and $C_3 = 0.1265$ [36]. From Eq. (5), to get a Stark broadening of only 0.1 nm with $T_e = 9000$ K, an electron density of about $n_e \sim 3 \times 10^{15}$ cm^{-3} is required, compared to that of the argon-hydrogen plasma of $< 10^9$ cm^{-3} determined using a compensated Langmuir probe, over six orders of magnitude less. Regional maxima in electron densities that could give rise to Stark broadening was eliminated as a possibility. The measured electron densities did not exceed 10^9 cm^{-3}, and the axial variation was weak, showing less than a factor of two change throughout the brightest region of the plasma. The high mass diffusivity of all of the species present made it unlikely that a large density gradient existed anywhere in the plasma at steady state. This result was also evident by the good fit to a Gaussian profile recorded on the argon-hydrogen plasma rather than a Voigt profile as shown in Figure 10. In addition, the line broadening for Balmer β, γ, and δ was comparable to that of Balmer α; whereas, an absence of broadening beyond the instrument width was observed for the lines of argon or helium species such as the 667.73 nm and 591.2 nm Ar I lines and 667.816 nm and 587.56 nm He I lines. Thus, the Stark broadening was also insignificant.

A linear Stark effect arises from an applied electric field that splits the energy level with principal quantum number n into $(2n-1)$ equidistant sublevels. The magnitude of this effect given by Videnovic et al. [8] is about 2×10^{-2} $nm/kV \cdot cm^{-1}$. No appreciable applied electric field was present in our study; thus, the linear Stark effect should be negligible. The absence of broadening of the noble gas lines and the hydrogen lines of the controls confirmed the absence of a strong electric field. No charged resonator cavity surfaces were present since the plasmas was contained in a quartz tube with the cavity external to the tube. A microwave E-mode field does exist in the Evenson cavity that is a function of the reflected power [37-38], and the catalysis reaction is dependent on this field as discussed previously [39]. However, there is no cathode fall region and the magnitude of the microwave field is comparably much less than that found in the cathode fall region of a glow discharge cell.

To investigate whether the rt-plasmas of this study were optically thin or thick at a given frequency ω, the effective path length $\tau_\omega(L)$ was calculated from

$$\tau_\omega(L) = \kappa_\omega L \qquad (5)$$

where L is the path length and κ_ω is the absorption coefficient given by

$$\kappa_\omega = \sigma_\omega N_H \qquad (7)$$

where σ_ω is the absorption cross section and N_H is the number density of the absorber. For optically thin plasmas $\tau_\omega(L) < 1$, and for optically thick plasmas $\tau_\omega(L) > 1$. The absorption cross section for Balmer α emission is $\sigma = 1 \, X 10^{-16} \, cm^2$ [40]. By methods discussed previously [41-42], an estimate of the n=2 H atom density based on Lyman line intensity is $\sim 1 \, X 10^8 \, cm^{-3}$. Thus, for a plasma length of $5 \, cm$, $\tau_\omega(5 \, cm)$ for Balmer α is

$$\tau_\omega(5 \, cm) = \kappa_\omega L = \left(1 \, X 10^{-16} \, cm^2\right)\left(1 \, X 10^8 \, cm^{-3}\right)\left(5 \, cm\right) = 5 \, X 10^{-8} \qquad (8)$$

Since $\tau_\omega(5) <<< 1$, the argon-hydrogen plasmas were optically thin; so, the self absorption of 656.3 nm emission by n=2 state atomic hydrogen may be neglected as a source of the observed broadening.

As discussed above, an estimate based on emission line profiles places the total H atom density of the argon-hydrogen plasma at $\sim 3.5 \, X 10^{14} \, cm^{-3}$. Since this is overwhelmingly dominated by the ground state, $N_H = 3.5 \, X 10^{14} \, cm^{-3}$ will be used. Usually, the atomic hydrogen collisional cross section in plasmas is on the order of $10^{-18} \, cm^2$ [43]. Thus, for $N_H = 3.5 \, X 10^{14} \, cm^{-3}$, collisional or pressure broadening is negligible.

Section 51

Examiner Souw's erroneous analysis continues on pages 11-12 of the Appendix:

(f) Applicant's argument on pg. 140-142 regarding Luque's and Luggenhoelscher's references has no merit, not only because the references are not cited by the Examiner to refute Applicant's incorrect claim of the Doppler effect and "hydrino" (this is accomplished by Kovacevic's [6] by virtue of the plasma sheath effect), but instead, to compare with the 0.27 nm line broadening measured by Applicant (see previous recitation from Applicant's paper). However, irrespective of the validity of Applicant's unverified Doppler assumption, a proper conversion of Luggenhoelscher's line broadening leads to a comparable magnitude (15.2 eV) with Applicant's claimed 10 eV kinetic energy, as previously demonstrated by the Examiner. Any further argument over line broadening in applicant's data of record will be considered unpersuasive for the reasons given in section I.B.3.d(5).

Examiner Souw's arguments are completely unfounded based on his lack of understanding that 3.7 cm-1 corresponds to only 4.5 meV, a trivial effect as discussed in Sections 42-44 above. His position that microwave fields have such an effect in Applicant's cells is refuted even by the paper cited by the Examiner:

S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004).

Section 52

Examiner Souw summarizes his erroneous analysis of Applicant's scientific evidence on page 12 of his Appendix by further arguing:

(C) CONCLUSION

Not a single independent third party (one that is not funded by or in collaboration with applicant) has been able to confirm Applicant's claim(s). Therefore, serious doubts are raised as to the scientific reproducibility of Applicant's results. This situation is very similar to cold fusion, the latter having ultimately ended up with a final dismissal by the scientific community. Since Applicant's invention violates what is conventionally accepted in science, it is not <u>patentable</u>. Such an "invention" is also not useful, since it cannot be reproduced and used by others. Therefore, a rejection under § 101 and § 112/¶.1 is here proper.

The Examiner could not be more wrong. Applicant's results predicted by physical laws have been published in over 60 peer-reviewed journal articles and are disclosed in 112 articles, as summarized in the section entitled "Lower-Energy Hydrogen Experimental Data". Applicant's results have been replicated by many top laboratories as given in 51 independent test reports and papers summarized in the section entitled "Independent Test Results."

Section 53

Examiner Souw further concludes without adequate basis on page 12 of his Appendix that:

In summary, Applicant's claims on hydrino-based processes have neither a credible experimental confirmation nor a scientific basis (see also Part IIof this Appendix: Theoretical).

In summary, the Examiner has not presented a single viable alternative to challenge Applicant's overwhelming body of evidence that confirms the claimed reaction of atomic hydrogen to lower-energy states and the existence of the claimed hydrino.

Studies that experimentally confirm a novel reaction of atomic hydrogen which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n = 1$) state, a chemically generated or assisted plasma (rt-plasma), and produces novel hydride compounds are summarized in the section entitled, "Lower-Energy Hydrogen Experimental Data" and include including:

extreme ultraviolet (EUV) spectroscopy,[14]

characteristic emission from catalysis and the hydride ion products,[15]

lower-energy hydrogen emission,[16]

plasma formation,[17]

Balmer α line broadening,[18]

population inversion of hydrogen lines,[19]

elevated electron temperature,[20]

anomalous plasma afterglow duration,[21]

power generation,[22]

excessive light emission,[23] and

analysis of chemical compounds.[24]

Section 54

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[14] Reference Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76, 78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98, 101, 104, 108-112.

[15] Reference Nos. 24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91, 108.

[16] Reference Nos. 14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98, 101, 104, 110-112.

[17] Reference Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93, 108, 109.

[18] Reference Nos. 16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91, 92, 93, 95-97, 105, 108, 109.

[19] Reference Nos. 39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91.

[20] Reference Nos. 34-37, 43, 49, 63, 67, 73.

[21] Reference Nos. 12-13, 47, 81.

[22] Reference Nos. 30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98, 101, 104, 108, 110-112.

[23] Reference Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72. 109

[24] Reference Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100, 101, 104, 108, 110-112.

In the Section of the Souw Appendix entitled **"II. Theoretical Part,"** on page 14, Examiner Souw posits the following arguments that are easily rebutted:

> Applicant's response does not remove any of the Examiner's refutations of his Grand Unified Theory of Quantum Mechanics, hereinafter GUT, as presented in the original Souw Appendix included in the previous office action. Rather, Applicant's response adds a large number of new mathematical and physical errors. Because those new errors are numerous, it is not possible to analyze them one by one without ending up writing hundreds of pages. Therefore, as done with GUT in the previous Appendix, only the significant ones will be addressed in the following sections, which are divided into the same paragraphs or sections as in the previous Appendix.

Applicant shows herein that the Examiner is stuck in his myopic view of quantum weirdness that prevents him from understanding and applying physical laws correctly. In fact, the Examiner is confused as to what constitutes a physical law. The Examiner argues that the postulated mathematics of SQM is a physical law. The reality is that SQM is incompatible with the physical laws of Maxwell, Newton, and special and general relativity, which is well known. The Examiner's failure to grasp this basic concept exposes yet another fatal flaw in his analysis.

Applicant has now solved hundreds of atomic problems such as ionization energies of multi-electron atoms, excited states, spectral fine structure and hyperfine structure, bonding parameters, ratios of the masses of fundamental, particles, the nature of the chemical bond and fundamental particles, and more. These results are in stunning agreement with the data. Applicant has also had his theory reviewed by outside experts, all Ph.D.'s with high credentials. These experts agree with Applicant that physical laws do apply on the atomic scale after all in contrast to the long-held views of quantum weirdness according to SQM.

Review by Dr. Jonathan Phillips

Review of "The Grand Unified Theory of Classical Quantum Mechanics" by Randell L. Mills

Jonathan Phillips, University of New Mexico Nat'l Lab Professor, Farris Engineering Center, Albuquerque, NM 87131

A dispassionate analysis of modifications in physics theory over the last decade indicates a new paradigm is needed. Theory now requires neutrinos to both have mass and travel at the speed of light, indicates that greater than 90% of the universe is "dark matter" or "dark energy" of unspecified form and origin, and is in search of a vast modification to virtual particle theory to explain the missing "quantum foam." An older and still valid reason to look for a new paradigm: There is still no explanation for the postulated failure of Maxwell's equations "at the order of h." Even given the advantage of that postulate, QED cannot provide explanations of simple features of atoms such as the origin of electron spin, a reasonable derivation of the g-factor, or provide precise values of almost any of the features of multi-electron atoms, such as the energies of excited states. Using only Maxwell's equations and Newton's Laws, while explicitly ignoring Schrödinger's Equation, Dr. Mills has developed a revolutionary "new" quantum physics (Classical Quantum Mechanics, CQM), that to date has passed all experimental tests, and thus must be regarded as a valid scientific model. That is, without resort to a single adjustable parameter and employing only well known constants and standard laws of physics it provides precise quantitative agreement with one set of measured quantities after another. Not only does CQM yield quantitative agreement with data sets that overwhelm the current quantum paradigm, the solutions in most cases are simple, closed form algebraic solutions. If Occam's razor is our guide, Mills CQM is clearly the superior theory.

This reviewer finds the bound electron model to be compelling and complete, particularly because of the remarkable agreement with a wide range of data. The detailed and precise physical model of the bound electron, illustrated with excellent visual aids in the new edition, stands in sharp contrast to the hazy probability cloud of the QED paradigm. In the CQM model bound electrons are spherically symmetric shells of charge, with surface currents, that surround the atomic nucleus at quantized stable radii, the values of which can be determined using Maxwell's and Newton's Laws. In addition, the postulated current pattern of these physical electrons is shown to yield, simply using classical physics, the correct electron spin, and angular momentum. Moreover, the CQM model of the bound electron can solve, with computations performed easily using a spreadsheet, problems that have resisted the most intense applications of the conventional paradigm. Specifically, the CQM approach leads, for the first time, to closed form algebraic solutions that precisely describe the behavior of multi-electron atoms. For example, classical physics indicates that in order for the outer electron in a helium atom to be in a stable orbit it must see a central force equal to that required by Newton's Laws to keep an object in orbit. Those central forces for the outer electron in a helium atom will be a sum of the net electrostatic force of the enclosed electron and the enclosed protons, plus the magnetic interaction of the outer electron and inner electron. Thus, as Dr. Mills shows, classical physics leads to a simple force balance, which reduces to a cubic equation. This equation yields a single real solution for the radius. This radius is then used in the most elementary mechanics equations to yield the energy of each of the excited states. All excited states energies (more than 100), are readily *predicted* using as input to the final closed form equations only the "quantum numbers" of the states in question. For over 100 measured excited states of atomic helium the r^2 value is 0.999994, and the typical relative difference (measured-

predicted/measured) is about 5 significant figures, which is within the error of the experimental data. There are no "fudge factors" such as "zero point energy" in the equations, and the values for the constants are all taken from the NIST web pages. Moreover, the known scattering behavior of helium is in precise agreement with a sphere of the radius predicted by CQM. In contrast, in recent years the standard paradigm methods used to obtained these helium excited state energy values are not based in Schrödinger's equation, but rather complex (e.g., never closed form) derivative forms that invariably require the embrace of non-quantum concepts such as the existence of 'nodes' at which the 'functions' (not wave states) become "infinite." Also, probably due to both the computational resource investment required as well as the inaccuracy of the methods, no more than a handful of excited state energies are ever reported, and there is no basis given for assigning any of those values to particular excited states. The book details many other examples of success using the same CQM force balance approach. Applied to muonium, positronium, and hundreds of ionization energies this elegant, yet mathematically and physically simple, approach produces values in such close agreement with experiment that the results can only be described as stunning. In contrast, the many derivative QED approaches to these problems can best be described as torturous, inaccurate, and incomplete.

The scientific method compels Mills not merely to compare computations based on CQM theory with thoroughly vetted data sets, but to press forward with experimental tests of some of the more surprising predictions of the theory. Many of these are perfect for scientific tests as CQM predicts physical behavior completely at odds with that expected on the basis of conventional theory. Most extraordinary is the prediction that hydrogen can have hitherto undetected stable states in which the electron is at far lower energy levels, and hence the atom is physically smaller, than hydrogen in the almost universally accepted ground state. It is also predicted that transitions to these states will occur in specific mixed gas plasmas, including H_2/Ar, H_2/He and water. As outlined in the text, initial tests using EUV spectroscopy show the existence of spectral lines in precise agreement with this prediction of CQM. There is no conventional physics explanation for the presence of these lines in these mixed gas plasmas. The same is true of NMR spectra from products collected downstream from these plasmas, and careful calorimetry of the plasmas themselves. The calorimetry work shows as much as 30 W of excess energy from plasmas only a few centimeters in volume.

The implications of this new physics are unprecedented. Philosophically, we will move from a physical world which is at best stochastic, perhaps "uncertain," at the core, to a world of simple, immutable physical laws. Engineers will be challenged with the goal of tapping a new and apparently inexhaustible source of energy. Indeed, the new model makes it clear that potentially water can be "burned" to produce enormous energy (i.e. thousands of electron volts per hydrogen atoms) and a byproduct of inert hydrinos ("small hydrogen"), which Mills postulates are the missing dark matter of the universe. Given the success of the theory, which uses only classical physics, in producing simple closed formed solutions to observations that resisted decades of computational effort to match them using the standard paradigm, the success of initial experimental tests of the model, as well as the revolutionary scientific and social implications of this theory, it is clear that the scientific community has an obligation to

calmly and dispassionately test it.

Review by Dr. Shelby T. Brewer

Shelby T. Brewer is President of S. Brewer Enterprises, Inc. He was Chairman, President and CEO of ABB Combustion Engineering Nuclear Power Businesses from 1985 through 1995, accomplishing a major turnaround in this company, and positioning it as the world leader among nuclear suppliers. From 1981 through 1984, he was the top nuclear official in the Reagan Administration, as Assistant Secretary of Energy.

I grew up and was educated (1960s) in a time when Einstein's lifelong (but unattained) quest for a unified field theory was celebrated rather anecdotally, as a sort of historical curiosity. One spoke of theories as 'tools' or 'models'. The prevailing mentality was 'one model does not fit all.' A model would work and be useful in one set of circumstances, but not another; use a model to get practical results, but a pursuit of absolute unifying truth was regarded largely as a waste of candle wax.

Other characteristics of this time in science were intolerance, arrogance, and rigidity. Scientists preened and postured, became intensely political, and delegated the 'doing' of science to students. Science was becoming big science—a big governmental and corporate enterprise—demanding more resources and becoming less accountable. We now have an expensive standing army in American science, marching in place, with little creative, definable mission. Most of what passes for science is merely chauvinism—who has the largest accelerator, etc.

Now along comes Randell Mills. Without expending billions or even millions or even hundreds of thousands of US taxpayers' dollars, Dr. Mills has apparently completed Einstein's quest for a unified field theory. Dr. Mills' theory is presented in his book, *The Grand Unified Theory of Classical Quantum Mechanics* (July 2002). This is a huge achievement for three reasons. First, the Mills Theory tidies up theoretical physics by stitching together quantum mechanics and relativity. That in itself is a major triumph. Second, and more important, the Mills Theory explains several major empirical anomalies that have vexed physicists for decades: the sun's energy balance deficit; the dark matter in space phenomena; and mountains of atomic-electron spectral data that is inconsistent with prevailing theory. Third, the Mills Theory gives rise to the possibility of an inexhaustible energy source based on phenomenology not yet recognized and accepted by the scientific community.

Remarkably, Dr. Mills has developed his theory and its energy generation application as an entrepreneur—without largesse from the US Government, and without the benediction of the US scientific priesthood. Because his enterprise does not suffer these two impediments, it just might succeed. If so, Mills will be the next Thomas Edison.

Shelby T. Brewer
Former Assistant Secretary of Energy
(Top Nuclear Official in the Reagan Administration)

Review by Dr. Günther Landvogt

Dr. Günther Landvogt, "The Grand Unified Theory of Classical Quantum Mechanics", International Journal of Hydrogen Energy, Vol. 28, No. 10, (2003), p. 1155.

In "The Grand Unified Theory of Classical Quantum Mechanics", Dr. Randell L. Mills really presents what the title promises: a theory which unifies Maxwell's equations, Newton's laws, and special and general relativity, electro-dynamics, mechanics, and gravity unified in a consistent theory, reaching from subatomic particles to cosmological dimensions. Only two ideas are basically new: (1) An unconventional, but logical use of Maxwell's equations resulting in a revolutionary interpretation of the electron; (2) A slight modification of general relativity resulting in a revolutionary model of the Universe. The rest of his theory is remarkably old: Mills believes—and verifies—that all the "classical" laws being valid in the "classical" branches of physics also hold in the atomic and subatomic fields. He presents a "classical" quantum mechanics that is simple, transparent, straightforward, consistent, and powerful. It does not need any postulates; the classical laws (including Einstein's) and physical constants are sufficient. Mills' quantum physics makes extensive use of Planck's constant, but avoids too much uncertainty. It is based on Maxwell's wave equation rather than Schrödinger's. The rich harvest is a heavy book filled with a firework of theoretical and practical consequences. Mills' ingenious way of thinking creates in different physical areas astonishing results with fascinating mathematical simplicity and harmony. And his theory is strongly supported by the fact that nearly all these results are in comfortable accordance with experimental findings, sometimes with breathtaking accuracy. Mills predicts fractional quantum energy levels of hydrogen and offers the quasi-chemical process to realize them. His experiments demonstrate that it represents the potential of a highly promising energy source. This is only one example of practical outcome. The book offers far more and is a treasure for scientists and engineers who feel that they have a future. And Mills is still busy at work.

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Review by Dr. John J. Farrell

Dr. John J. Farrell

Professor of Chemistry, Emeritus

Franklin & Marshall College

February 10, 2004

The grand unified theory of classical quantum mechanics proposed by Randell L. Mills is breathtaking and powerful. Mills has successfully unified electrodynamics and gravity by applying Maxwell's equations, Newton's laws, and Einstein's special and general relativity with his exceptionally creative and quantitative mind.

Mills begins his theory by developing an entirely new description of the electron in the hydrogen atom (using Maxwell's equations). Unlike standard quantum mechanics, which describes the electron as a point particle, Mills finds that the electron is an infinite number great circles that comprise the surface of a sphere at the Bohr radius. The sum of the masses of all of the great circles is equal to the mass of one electron. Similarly, the sum of charges of all of the great circles is equal to the charge of one electron. After solving for the energy, the angular velocity and the radius of the electron (great circles), Mills derives the correct value for the angular momentum of the electron, h/2(. This is astonishing because theoreticians gave up on associating any systematic motion of the electron with its known angular momentum decades ago hence, the term intrinsic spin angular momentum. Amazingly, Mills goes on to derive, using the same motion of the electron but now considering its charge, the correct magnetic field and value of the magnetic moment of the electron. The chances of deriving the correct values for both the angular momentum and the magnetic moment of the electron without the correct motion of the electron is, quite frankly, zero. Mills must have the correct motion of the electron in the hydrogen atom. Armed with this knowledge, he then derives the values of all of the known physical parameters of the hydrogen atom.

The fun does not stop there. Mills goes on to derive hundreds of physical parameters, such as the masses of leptons, quarks, and gluons. He makes predictions for many aspects of nature for which we do not have known values and for which the predicted values are unanticipated: the acceleration of the expansion of the cosmos; the existence of old galaxies at the beginning of the current cosmological expansion; the maximum and minimum radii of the universe and how long it takes to complete one cycle about 1,000 billion years to go from minimum to maximum and back to minimum again. He not only predicts fractional quantum states for the hydrogen atom (n = 1/2, 1/3, 1/4, Ö), he has identified the extreme ultraviolet spectral lines that result from their formation in hydrogen/helium plasmas.

Mills' grand unified theory of classical quantum mechanics explains the answers to some very old scientific questions, such as what happens to a photon upon absorption and some very modern ones, such as what is dark matter. His theory explains why the Sun's corona is so hot (>1,000,000 K) in spite of the fact that Sun's surface is so cool (6,000 K). Astounding.

What does all of this mean to the average person? A lot. The technology that ensues from Mills' theory will change almost every facet of life for everyone on the planet. The most immediate change will be in how we produce and use energy. The obtainable energies from the catalytic formation of fractional quantum states of hydrogen are intermediate between normal chemical energies and nuclear energies. The advantage here is that the fuel is abundant, non-polluting hydrogen. Scientists, engineers, and economists have touted the hydrogen economy for several decades. Little did they know that it would take the form of catalytically converting hydrogen to lower energy states of hydrogen! Truly, reality is stranger than fiction. The possibilities of this one aspect, energy production, boggle the mind. Furthermore, lower energy hydrogen will double (quadruple?) known chemistry. These smaller-than-normal hydrogen atoms should form chemical bonds that are two to ten times stronger than any known chemical bond. Imagine the strong fibers, the hard surfaces, the materials that will last for decades or centuries without corrosion, the extremely high-voltage batteries that will be possible all made with the light element hydrogen. Have I mentioned the implications of correctly understanding gravity?

Lastly, Mills has made an extremely important contribution to the philosophy of science. He has reestablished cause and effect as the basic principle of science. Probability and chance will still rule at Las Vegas and Atlantic City, but not in the laboratory. Einstein would be pleased.

Multiple theory papers are also accepted for publication in peer-reviewed journals.

Section 55

Examiner Souw continues his error-prone analysis with the following statements appearing on page 14 of his Appendix:

1. Regarding the derivation of hydrino's fractional energy levels, E_n

(a) Applicant's arguments regarding GUT, Ch. 1-2, 5-6, as recited in his response on pg.37 are unpersuasive: Applicant's formula for E_n is not derived, but postulated, just as stated by the Examiner so far. First-principle means, the principal formula must come out of mathematical derivation. Thus, applicant's formula is not from first principles. It is to be known, that postulate is acceptable in science (e.g., QM), insofar it is supported by experimental evidence and does not contradict with known natural laws. This is not the case with the hydrino. Its existence is not supported by experimental evidence and is also in violation of quantum mechanics (QM), electrodynamics, and the relativity theory.

The hydrino states are derived from Maxwell's equations and other first principle laws in GUT, Ch. 1-2, 5-6. This can be confirmed by the comparing the match between predictions and experiment observations of conjugate observables using the same solution of the one electron atom as used to derive the hydrino states.

Some of the many confirmatory results are:

STERN-GERLACH EXPERIMENT

The Stern-Gerlach experiment implies a magnetic moment of one Bohr magneton and an associated angular momentum quantum number of 1/2. Historically, this quantum number is called the spin quantum number, s ($s = \frac{1}{2}$; $m_s = \pm\frac{1}{2}$). The superposition of the vector projection of the orbitsphere angular momentum on the z-axis is $\frac{\hbar}{2}$ with an orthogonal component of $\frac{\hbar}{4}$. Excitation of a resonant Larmor precession gives rise to $\hbar$ on an axis S that precesses about the z-axis called the spin axis at the Larmor frequency at an angle of $\theta = \frac{\pi}{3}$ to give a perpendicular projection of

$$S_\perp = \pm\sqrt{\frac{3}{4}}\hbar \tag{1}$$

and a projection onto the axis of the applied magnetic field of

$$S_\parallel = \pm\frac{\hbar}{2} \tag{2}$$

The superposition of the $\frac{\hbar}{2}$, z-axis component of the orbitsphere angular momentum and the $\frac{\hbar}{2}$, z-axis component of S gives $\hbar$ corresponding to the observed electron magnetic moment of a Bohr magneton, μ_B.

ELECTRON g FACTOR

Conservation of angular momentum of the orbitsphere permits a discrete change

of its "kinetic angular momentum" $(\mathbf{r} \times m\mathbf{v})$ by the applied magnetic field of $\frac{\hbar}{2}$, and

concomitantly the "potential angular momentum" $(\mathbf{r} \times e\mathbf{A})$ must change by $-\frac{\hbar}{2}$.

$$\Delta\mathbf{L} = \frac{\hbar}{2} - \mathbf{r} \times e\mathbf{A} \tag{3}$$

$$= \left[\frac{\hbar}{2} - \frac{e\phi}{2\pi}\right]\hat{z} \tag{4}$$

In order that the change of angular momentum, $\Delta\mathbf{L}$, equals zero, ϕ must be $\Phi_0 = \frac{h}{2e}$,

the magnetic flux quantum. The magnetic moment of the electron is parallel or

antiparallel to the applied field only. During the spin-flip transition, power must be

conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \bullet (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o\mathbf{H}\bullet\mathbf{H}\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o\mathbf{E}\bullet\mathbf{E}\right] - \mathbf{J}\bullet\mathbf{E} \tag{5}$$

Eq. (6) gives the total energy of the flip transition which is the sum of the energy of

reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the

electric energy (3rd term), and the dissipated energy of a fluxon treading the

orbitsphere (4th term), respectively,

$$\Delta E_{mag}^{spin} = 2\left(1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2\right)\mu_B B \tag{6}$$

$$\Delta E_{mag}^{spin} = g\mu_B B \tag{7}$$

where the stored magnetic energy corresponding to the $\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o\mathbf{H}\bullet\mathbf{H}\right]$ term increases,

the stored electric energy corresponding to the $\frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o\mathbf{E}\bullet\mathbf{E}\right]$ term increases, and the

$\mathbf{J}\bullet\mathbf{E}$ term is dissipative. The spin-flip transition can be considered as involving a

magnetic moment of g times that of a Bohr magneton. The g factor is redesignated

the fluxon g factor as opposed to the anomalous g factor. Using $\alpha^{-1} = 137.03603(82)$,

the calculated value of $\frac{g}{2}$ is **1.001 159 652 137**. The experimental value [1] of $\frac{g}{2}$ is **1.001 159 652 188(4)**.

References

1. R. S. Van Dyck, Jr., P. Schwinberg, H. Dehmelt, "New high precision comparison of electron and positron g factors", Phys. Rev. Lett., Vol. 59, (1987), p. 26-29.

Lamb Shift

The Lamb Shift of the $^2P_{1/2}$ state of the hydrogen atom is due to conservation of energy and linear momentum of the emitted photon, electron, and atom.

Electron Component

$$\Delta f = \frac{\Delta \omega}{2\pi} = \frac{E_{h\upsilon}}{h} = \frac{\left(E_{h\upsilon}\right)^2}{2h\mu_e c^2} = 1052.48 \; MHz$$

where $E_{h\upsilon}$ is

$$E_{hv} = 13.5983 \; eV\left(1 - \frac{1}{n^2}\right)\frac{3}{4\pi}\sqrt{\frac{3}{4}} - h\Delta f$$

$$h\Delta f <<< 10 \; eV; \quad n = 2$$

$$\therefore E_{hv} = 13.5983 \; eV\left(1 - \frac{1}{2^2}\right)\frac{3}{4\pi}\sqrt{\frac{3}{4}}$$

Atom Component

$$\Delta f = \frac{\Delta \omega}{2\pi} = \frac{E_{h\upsilon}}{h} = \frac{\left(E_{h\upsilon}\right)^2}{2hm_H c^2} = \frac{\left(13.5983 \; eV\left(1 - \frac{1}{2^2}\right)\left(1 + \frac{1}{2} - \sqrt{\frac{3}{4}}\right)\right)^2}{2hm_H c^2} = 5.3839 \; MHz$$

Sum of Components

$$\Delta f = 1052.48 \; MHz + 5.3839 \; MHz = 1057.87 \; MHz$$

The experimental Lamb Shift is $\Delta f = 1057.862 \; MHz$

The other core results of SQM can be replicated using closed form equations containing fundamental constants only without involving renormalization and virtual particles. The results derived from Maxwell's equations are in remarkable agreement between the calculated and experimental values that are only limited by the accuracy of the fundamental constants.

FINE STRUCTURE

The fine structure energy is the Lamb-shifted relativistic interaction energy between the spin and orbital magnetic moments due to the corresponding angular momenta.

The energy, E_{FS} and frequency, Δf_{FS}, for the $^2P_{3/2} \rightarrow {}^2P_{1/2}$ transition called the fine structure splitting is given by the sum:

$$E_{FS} = \frac{\alpha^5 (2\pi)^2}{8} m_e c^2 \sqrt{\frac{3}{4}} + \left(13.5983 \ eV\left(1-\frac{1}{2^2}\right)\right)^2 \left[\frac{\left(\frac{3}{4\pi}\left(1-\sqrt{\frac{3}{4}}\right)\right)^2}{2h\mu_e c^2} + \frac{\left(1+\left(1-\sqrt{\frac{3}{4}}\right)\right)^2}{2hm_H c^2}\right]$$

$$= 4.5190 \ X \ 10^{-5} \ eV + 1.75407 \ X \ 10^{-7} \ eV$$

$$= 4.53659 \ X \ 10^{-5} \ eV$$

$$\Delta f_{FS} = 10,927.0 \ MHz + 42.4132 \ MHz = 10,969.4 \ MHz$$

The energy of $4.53659 \ X \ 10^{-5} \ eV$ corresponds to a frequency of $10,969.4 \ MHz$, or a wavelength of $2.73298 \ cm$.

The experimental value of the $^2P_{3/2} - {}^2P_{1/2}$ transition frequency is $10,969.1 \ MHz$.

HYPERFINE STRUCTURE

The hyperfine structure of the hydrogen atom is calculated from the force balance contribution between the electron and the proton.

The energy corresponds to the Stern-Gerlach and stored electric and magnetic energy changes.

The total energy of the transition from antiparallel to parallel alignment, $\Delta E_{total}^{S/N}$, is given as the sum:

$$\Delta E_{total}^{S/N} = -\mu_0 \mu_B \mu_P \sqrt{\frac{3}{4}} \left(\frac{1}{r_+^3} + \frac{1}{r_-^3} \right) + \frac{-e^2}{8\pi\varepsilon_o} \left[\frac{1}{r_+} - \frac{1}{r_-} \right] + \left(-1 - \left(\frac{2}{3} \right)^2 - \frac{\alpha}{4} \right) 4\pi\mu_o \mu_B^2 \left(\frac{1}{r_+^3} - \frac{1}{r_-^3} \right)$$

$$= -1.918365 \times 10^{-24} \, J + 9.597048 \times 10^{-25} \, J + 1.748861 \times 10^{-26} \, J$$

$$= -9.411714 \times 10^{-25} \, J$$

where

$$r = a_H \pm \frac{2\pi\alpha \mu_P}{ec} \sqrt{\frac{3}{4}}$$

The energy is expressed in terms of wavelength using the Planck relationship:

$$\lambda = \frac{hc}{\Delta E_{total}^{S/N}} = 21.10610 \, cm$$

The experimental value from the hydrogen maser is $21.10611 \, cm$.

MUONIUM HYPERFINE STRUCTURE INTERVAL

The hyperfine structure of muonium is calculated from the force balance contribution between the electron and muon.

The energy corresponds to the Stern-Gerlach and stored electric and magnetic energy changes.

The energy of the ground state $(1^2S_{1/2})$ hyperfine structure interval of muonium, $\Delta E(\Delta v_{Mu})$, is given by the sum:

$$\Delta E(\Delta v_{Mu}) = -\mu_0 \mu_B \mu_\mu \sqrt{\frac{3}{4}} \left(\frac{1}{r_{2+}^3} + \frac{1}{r_{2-}^3} \right) + \frac{-e^2}{8\pi\varepsilon_o} \left[\frac{1}{r_{2+}} - \frac{1}{r_{2-}} \right]$$

$$+ 4\pi\mu_o \left(-1 - \left(\frac{2}{3}\cos\frac{\pi}{3} \right)^2 - \alpha \right) \left(\mu_B^2 \left(\frac{1}{r_{2+}^3} - \frac{1}{r_{2-}^3} \right) + \mu_{B,\mu}^2 \left(\frac{1}{r_{1+}^3} - \frac{1}{r_{1-}^3} \right) \right)$$

$$= -6.02890320 \times 10^{-24}\ J + 3.02903048 \times 10^{-24}\ J + 4.23209178 \times 10^{-26}\ J + 1.36122030 \times 10^{-28}\ J$$

$$= -2.95741568 \times 10^{-24}\ J$$

where

$$r_2 = a_\mu \pm \frac{2\pi\alpha\mu_\mu}{ec}\sqrt{\frac{3}{4}}$$

and

$$r_1 = \frac{a_\mu \pm \dfrac{2\pi\alpha\mu_\mu}{ec}\sqrt{\dfrac{3}{4}}}{\left(\dfrac{m_\mu}{m_e} \pm \dfrac{m_\mu eac}{2\hbar^2}\mu_0\mu_\mu\sqrt{\dfrac{3}{4}} \right)^{1/3}}$$

Using Planck's equation, the interval frequency, Δv_{Mu}, and wavelength, $\Delta\lambda_{Mu}$, are

$$\Delta v_{Mu} = 4.46330328\ GHz$$

$$\Delta\lambda_{Mu} = 6.71682919\ cm$$

The experimental hyperfine structure interval of muonium is

$$\Delta E\left(\Delta v_{Mu}\right) = -2.957415336\,X\,10^{-24}\,J$$

$$\Delta v_{Mu} = 4.463302765(53)\,GHz\,\left(12\,ppm\right)$$

$$\Delta \lambda_{Mu} = 6.71682998\ cm$$

POSITRONIUM HYPERFINE STRUCTURE

The leptons are at the same radius, and the positronium hyperfine interval is given by the sum of the Stern-Gerlach, $\Delta E_{spin\text{-}spin}$, and fine structure, $\Delta E_{s/o}(^3S_1 \rightarrow {}^1S_0)$, energies.

The hyperfine structure interval of positronium $(^3S_1 \rightarrow {}^1S_0)$ is given by the sum:

$$\Delta E_{\text{Ps hyperfine}} = \Delta E_{spin\text{-}spin} + \Delta E_{s/o}(^3S_1 \rightarrow {}^1S_0)$$

$$= \frac{g\mu_o e^2 \hbar^2}{8m_e^2 (2a_0)^3} + \frac{3g\alpha^5 (2\pi)^2}{8} m_e c^2 \sqrt{\frac{3}{4}}$$

$$= \frac{g\alpha^5 (2\pi)^2}{8} m_e c^2 \left(\frac{1}{8\pi\alpha} + \frac{3\sqrt{3}}{2}\right)$$

$$= 8.41155110\,X\,10^{-4}\,eV$$

Using Planck's equation, the interval in frequency, $\Delta \upsilon$, is

$$\Delta \upsilon = 203.39041\ GHz$$

The experimental ground-state hyperfine structure interval is

$$\Delta E_{\text{Ps hyperfine}}\,(\text{experimental}) = 8.41143\,X\,10^{-4}\,eV$$

$$\Delta \upsilon(\text{experimental}) = 203.38910(74)\,GHz\,(3.6\,ppm)$$

The relativistic one-electron atom ionization energies in closed-form equations with fundamental constants are given by

$$\gamma^* = \frac{2\pi}{2\pi\sqrt{1-\left(\frac{v}{c}\right)^2}\sin\left[\frac{\pi}{2}\left(1-\left(\frac{v}{c}\right)^2\right)^{3/2}\right]+\cos\left[\frac{\pi}{2}\left(1-\left(\frac{v}{c}\right)^2\right)^{3/2}\right]} \qquad (1.250)$$

$$E_{ele} = -\gamma^* \frac{Z^2 e^2}{8\pi\varepsilon_o a_0}\frac{\mu}{m_e} = -\gamma^* \frac{\mu}{m_e}Z^2 X 2.1799 X 10^{-18} J = -\gamma^* \frac{\mu}{m_e}Z^2 X 13.606 \, eV \qquad (1.251)$$

Table 1.5. Relativistically corrected ionization energies for some one-electron atoms.

One e Atom	Z	γ^* a	Theoretical Ionization Energies (eV) b	Experimental Ionization Energies (eV) c	Relative Difference between Experimental and Calculated d
H	1	1.000007	13.59838	13.59844	0.00000
He^+	2	1.000027	54.40941	54.41778	0.00015
Li^{2+}	3	1.000061	122.43642	122.45429	0.00015
Be^{3+}	4	1.000109	217.68510	217.71865	0.00015
B^{4+}	5	1.000172	340.16367	340.2258	0.00018
C^{5+}	6	1.000251	489.88324	489.99334	0.00022
N^{6+}	7	1.000347	666.85813	667.046	0.00028
O^{7+}	8	1.000461	871.10635	871.4101	0.00035
F^{8+}	9	1.000595	1102.65013	1103.1176	0.00042
Ne^{9+}	10	1.000751	1361.51654	1362.1995	0.00050
Na^{10+}	11	1.000930	1647.73821	1648.702	0.00058
Mg^{11+}	12	1.001135	1961.35405	1962.665	0.00067
Al^{12+}	13	1.001368	2302.41017	2304.141	0.00075
Si^{13+}	14	1.001631	2670.96078	2673.182	0.00083
P^{14+}	15	1.001927	3067.06918	3069.842	0.00090
S^{15+}	16	1.002260	3490.80890	3494.1892	0.00097
Cl^{16+}	17	1.002631	3942.26481	3946.296	0.00102
Ar^{17+}	18	1.003045	4421.53438	4426.2296	0.00106
K^{18+}	19	1.003505	4928.72898	4934.046	0.00108
Ca^{19+}	20	1.004014	5463.97524	5469.864	0.00108
Sc^{20+}	21	1.004577	6027.41657	6033.712	0.00104
Ti^{21+}	22	1.005197	6619.21462	6625.82	0.00100
V^{22+}	23	1.005879	7239.55091	7246.12	0.00091
Cr^{23+}	24	1.006626	7888.62855	7894.81	0.00078
Mn^{24+}	25	1.007444	8566.67392	8571.94	0.00061
Fe^{25+}	26	1.008338	9273.93857	9277.69	0.00040
Co^{26+}	27	1.009311	10010.70111	10012.12	0.00014
Ni^{27+}	28	1.010370	10777.26918	10775.4	-0.00017
Cu^{28+}	29	1.011520	11573.98161	11567.617	-0.00055

a From theoretical calculations, interpolation of H isoelectronic and Rydberg series, and experimental data [43-44].

b (Experimental-theoretical)/experimental.

43. C. E. Moore, "Ionization Potentials and Ionization Limits Derived from the Analyses of Optical Spectra, Nat. Stand. Ref. Data Ser.-Nat. Bur. Stand. (U.S.), No. 34, 1970.

44. D. R. Lide, *CRC Handbook of Chemistry and Physics*, 79 th Edition, CRC Press, Boca Raton, Florida, (1998-9), p. 10-175 to p. 10-177.

These results can not be matched with SQM, which is not predictive. They also disprove the Examiner's position that the hydrino states are not derived.

Section 56

Examiner Souw further argues on page 15 of his Appendix that:

(b) As already demonstrated in said Appendix, those GUT chapters are full of mathematical flaws and violations of elementary principles of physics, some of which have been previously discussed and will be consequently prosecuted in the following sections.

These results are derived from physical laws and do not contain mathematical errors as confirmed by the remarkable agreement between the calculated and experimental results and as confirmed by independent peer review as discussed in Sections 54-55 above. The Examiner's inability to overcome these stunning results is patently obvious and only further highlights the bias inherent in his faulty analysis.

Section 57

Examiner Souw further states on page 15 of his Appendix:

2.   Regarding the alleged "electrostatic Schrödinger Equation (SE)" and "stationary electron"

(a) Applicant has misrepresented the Examiner's previous statements as none of the wording alleged by Applicant, i.e., "electrostatic Schrödinger Equation (SE)" and "stationary electron" is recited by the Examiner in said Appendix. As such, the Examiner is not giving any weight to these arguments thus presented.

Examiner Souw, however, has not provided a basis for the stability of a point electron bound to a proton. It must radiate according to Maxwell's equations. More on the instability of the hydrogen atom according to SQM is given below.

Section 58

Examiner Souw continues with his erroneous analysis on pages 15-16 of his Appendix, arguing that:

> (b) Applicant has misunderstood the fundamental QM concept of "stationary state" (see original Souw Appendix pg. 1/ sect.2/lines I and 3), in which the term "stationary" (or "static") simply means "does not change with time" (as defined in the Appendix pg.2/line 1). This "stationary state" is a fundamental concept that can be found in every QM textbook (see, e.g., McQuarrie [1], Ch.4.3, pg. 121, lines 2-3 from bottom, *"Thus, the probability density and the averages calculated from Eq. 4-19 are independent of time, and the $\emptyset_n(x)$ are called stationary-state wave functions"*. As such, the wording "stationary state" would never be misinterpreted as "motionless electron" by any one of ordinary skill in the art. As known in the art, an electron in a stationary state is in motion, wherein the motion, or velocity, is inherent in the wavefunction, and is represented by the eigenvalue (for a single state) or expectation value (for a superposition of states) of the particle momentum operator *p* (operators are written in *bold italics)* divided by the mass m (scalar non-operator), i.e., *V=p/m,* such that the particle velocity is <*V*> = (1/m)?<ø*,*pø*>, in which the operator *p* is represented by -i_ **grad** in the Schrödinger representation. The "stationary" state or "static" probability density (to be distinguished from Applicant's stationary electron) is a direct consequence of the uncertainty relation (see original Souw Appendix/lines 8-10), since the energy E of the state, and also its angular momentum L, are sharply defined, i.e., äE=O and äL=O, which consequently leads to ät=? (does not change with time) and äö=2∂ (total uncertainty of angular position ö), the latter because the angular momentum operator is defined as *L*=i_?/?? (or by scalar operator L^2), and the complementary of the angular momentum is the angular position p, which is equivalent to the complementarity between *p* and *x*, leading to äx=? for äp=0 in case of linear momentum and position. In simple terms understandable to those ordinarily skilled in the art, an electron plane wave represented by ø~exp(ikx-iùt) also results in a stationary probability (charge) density, p = $|ø|^2$ = constant in time, i.e., static, per definition. However, the electron itself (to be distinguished from its state or probability density) is not stationary or static, but instead, moving with a momentum of p=_k and a kinetic energy of E=_$^2k^2$/2m. This is a most basic element of QM well known to-those ordinarily skilled in the art. For these reasons, Applicant's "refutation" of the QM are unpersuasive.

These arguments have no merit inasmuch as Examiner Souw presents an impossible situation—that of a moving point electron that is **always** constant in its position/distribution. Furthermore, the Examiner contradicts himself once again by

stating that the average distribution is constant. This is very different from the instantaneous position being constant. It is the inconstancy of the latter that must give rise to radiation.

It is well known that the Bohr model gives a constant average position/distribution of the harmonic motion, but it is also predicted to radiate due to the instantaneous motion that is not constant.

Section 59

On pages 16-17 of his Appendix, Examiner Souw once again erroneously argues that:

> The QM method of calculating spectral line intensities based on vector- and tensoroperators as presented, e.g., by Condon EU. & Shortley G.H., "The Theory of Atomic Spectra", Cambridge 1967, pp. 45-69, and 112-147 [2], has been mathematically implemented and experimentally verified by the Examiner himself in his two previously cited works [3, 4]. The experimental verification involving hundreds of spectral lines as functions of electric/magnetic fields was made without a single error or failure. The results were extremely accurate within less than 10^{-5} nm, which is far more superior to the 0.1 nm accuracy achieved in Applicant's measurements. As a proof for the correctness of conventional QM, similar mathematical verifications have been also demonstrated by a great number of other authors. In this regard, a reference to the Examiner's own work is here to be considered important, so as to exclude the possibility of an invalid dismissal from Applicant's side, such as "the Examiner misunderstands his own reference". As already brought up in the previous Appendix, Applicant's Grand Unified Theory (GUT) wave function is incapable of calculating line splitting and line intensities, including line absorption cross-sections, as the conventional QM is evidently capable of (see [2], [3] and [4]). Applicant is invited to present detailed step-by-step calculations showing how his theory is capable of predicting the line intensities and applicant has not done so to date.

The supposedly accurate results of quantum mechanics for spectral lines are easily explainable—they are due to the remarkable ability to use computers for curve fitting. The Examiner has provided no evidence that any calculation based on SQM is grounded in physical laws. Applicant has now calculated the excited state spectrum of helium in closed-form equations with fundamental constants only. The agreement of the precise values obtained by inserting the quantum number of the state into the

equations is in remarkable agreement with the NIST values for over 100 reported states. The same solutions predict the other conjugate parameters of the helium atom for the first time. These results have not been matched by SQM in the 80 years of its existence.

The abstract is given as follows:

106. **R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Foundation Louis de Broglie, submitted.**

Quantum mechanics (QM) and quantum electrodynamics (QED) are often touted as the most successful theories ever. In this paper, this claim is critically evaluated by a test of internal consistency for the ability to calculate the conjugate observables of the nature of the free electron, ionization energy, elastic electron scattering, and the excited states of the helium atom using the same solution for each of the separate experimental measurements. It is found that in some cases quantum gives good numbers, but the solutions are meaningless numbers since each has no relationship to providing an accurate physical model. Rather, the goal is to mathematically reproduce an experimental or prior theoretical number using adjustable parameters including arbitrary wave functions in computer algorithms with precision that is often much greater (e.g. 8 significant figures greater) than possible based on the propagation of errors in the measured fundamental constants implicit in the physical problem. Given the constraints of adherence to physical laws and internal consistency, an extensive literature search indicates that quantum mechanics has never solved a single physical problem correctly including the hydrogen atom and the next member of the periodic chart, the helium atom. Rather than using postulated unverifiable theories that treat atomic particles as if they were not real, physical laws are now applied to the same problem. In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, a classical approach is explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level. The proverbial view deeply seated in the wave-particle duality notion that there is no large-scale physical counterpart to the nature of the electron is shown not to be correct. Physical laws and intuition may be restored when dealing with the wave equation and quantum atomic problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles as reported previously

[1-6] that successfully applies physical laws to the solution of atomic problems that has its basis in a breakthrough in the understanding of the stability of the bound electron to radiation. Rather than using the postulated Schrödinger boundary condition: "$\Psi \to 0$ as $r \to \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$-state electron cannot radiate energy.* Although it is well known that an accelerated *point* particle radiates, an *extended distribution* modeled as a superposition of accelerating charges does not have to radiate. A simple invariant physical model arises naturally wherein the predicted results are extremely straightforward and internally consistent requiring minimal math as in the case of the most famous equations of Newton, Maxwell, Einstein, de Broglie, and Planck on which the model is based. No new physics is needed; only the known physical laws based on direct observation are used. The accurate solution of the helium atom is confirmed by the agreement of predicted and observed conjugate parameters using the same unique physical model in all cases.

Applicant has also correctly calculated the energy levels for over 100 Stark split states of hydrogen, derived correctly the selection rules and derived the equation for line intensities in Ref. #1 (GUT Chp. 2), a truly remarkable accomplishment.

What is not so remarkable is that the Examiner can not see past his own biases to allow himself to even consider Applicant's evidence objectively.

Section 60

The inconsistencies that predominate Examiner Souw's analysis can also be found on pages 17-18 of the Appendix, which states:

(c) Regarding pg.40 of the amendment, the Examiner's argument has been (and is),that not only the ground state, but **all stationary states** must be also non-radiative in consequence of the Haus theorem, since their probability density distribution does not change with time (i.e., per definition, stationary; see previous Appendix section 2, lines 1-2). To "see" an electron physically moving around an atom, a wave packet has to be constructed as a superposition of stationary states having not only a plurality of orbital quantum numbers (L,m), as described in the original Souw Appendix, sect.2, but also involving at least two principal quantum numbers, n_1 and n_2, as discussed in the original Appendix sect.3. Only then, can a non-vanishing time dependence of the probability density be established, i.e., by virtue of the cross-term $p = |\phi|^2 \sim \exp i(\dot{u}_1 - \dot{u}_2) \cdot t$ (Note: the energy of a free hydrogen atom, and hence, its frequency, $\dot{u}_n = E_n/\_$, only depends on the principal quantum number

n). This corresponds to the transition probability discussed in sect.3 of the original Appendix, which also agrees with the Haus's condition, that a free hydrogen atom composed of at least two eigenstates of different principal quantum numbers <u>does radiate</u>, i.e., making a transition from n_2-state to n_1-state.

Here again, Examiner Souw makes an internally inconsistent argument in claiming that "not only the ground state, but <u>all stationary states</u> must be also non-radiate in consequence of the Haus theorem". Then he states that " a free hydrogen atom composed of at least two eigenstates of different principal quantum numbers <u>does radiate</u>, i.e., making a transition from n_2-state to n_1-state". Such inconsistencies only add to the fatal flaws plaguing the Examiner's erroneous analysis.

Section 61

Examiner Souw further argues on page 18 of his Appendix that:

> This conclusion regarding stationary states is a direct consequence of the Heisenberg Uncertainty Principle, and has been made by the Examiner independent from --but in agreement with-- Feynman and other authorities in QM, the latter contended by the Applicant himself (see 2.d.(5) below).

Other authorities, including theoreticians from Princeton University, agree with Applicant that the Feynman argument that the stability of the hydrogen atom is based on the Heisenberg Uncertainty Principle is false.

Under SQM, the electron is not stable to radiation and states of lower energy than the $n=1$ state are not precluded. This point is shown by Applicant's analysis [80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted] as well as by other theoreticians such as those at Princeton University who show that the Heisenberg Uncertainty Principle provides no atomic stability [E. H. Lieb, "The stability of matter", Reviews of Modern Physics, Vol. 48, No. 4, (1976), pp, 553-569]. The abstract of Ref. #80 is given below:

Abstract
Recently published data showing that the Rydberg series extends to lower states in a catalytic plasma reaction [R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied

Physics, Vol. 36, (2003), pp. 1535-1542] has implication for the theoretical basis of the stability of the hydrogen atom. The hydrogen atom is the only real problem for which the Schrödinger equation can be solved without approximations; however, it only provides three quantum numbers—not four, and inescapable disagreements between observation and predictions arise from the later postulated Dirac equation as well as the Schrödinger equation. Furthermore, unlike physical laws such as Maxwell's equations, it is always disconcerting to those that study quantum mechanics (QM) that the particle-wave equation and the intrinsic Heisenberg Uncertainty Principle (HUP) must be accepted without any underlying physical basis for fundamental observables such as the stability of the hydrogen atom in the first place. In this instance, a circular argument regarding definitions for parameters in the wave equation solutions and the Rydberg series of spectral lines replaces a first-principles-based prediction of those lines. It is shown that the quantum theories of Bohr, Schrodinger, and Dirac provide no intrinsic stability of the hydrogen atom based on physics. An old argument from Feynman based on the HUP is shown to be internally inconsistent and fatally flawed. This argument and some more recent ones further brings to light the many inconsistencies and shortcomings of QM and the intrinsic HUP that have not been reconciled from the days of their inception. The issue of stability to radiation needs to be resolved, and the solution may eliminate of some of the mysteries and intrinsic problems of QM.

Section 62

On page 18 of the Souw Appendix, the Examiner makes the following astounding statement:

> In contrast, Applicant's theory based on point electron, as recited in GUT and on pg.39 is incorrect, since it is in total contradiction to and not reconcilable with the routine experimental observations of electron wave properties, such as interference effects that have found many useful applications, e.g., Reflection High Energy Electron Diffraction (RHEED) and Low Energy Electron Diffraction (LEED).

It is hard to believe that the Examiner has read anything on CQM. The fundamental premise of CQM is that the electron is not a point such as it is in SQM. For special extended distributions, acceleration without radiation is possible. On this basis, the extended charge-density functions are derived from Maxwell's equations. To assist the Examiner in understanding this concept, a picture of the bound and free electron charge (mass)-density functions are given below:

Figure 1.1. The orbitsphere is a two-dimensional spherical shell of zero thickness with the Bohr radius of the hydrogen atom, $r = a_H$. It is nonradiative, a minimum-energy surface, and extremely stable in that the balanced forces correspond to a pressure of twenty million atmospheres.
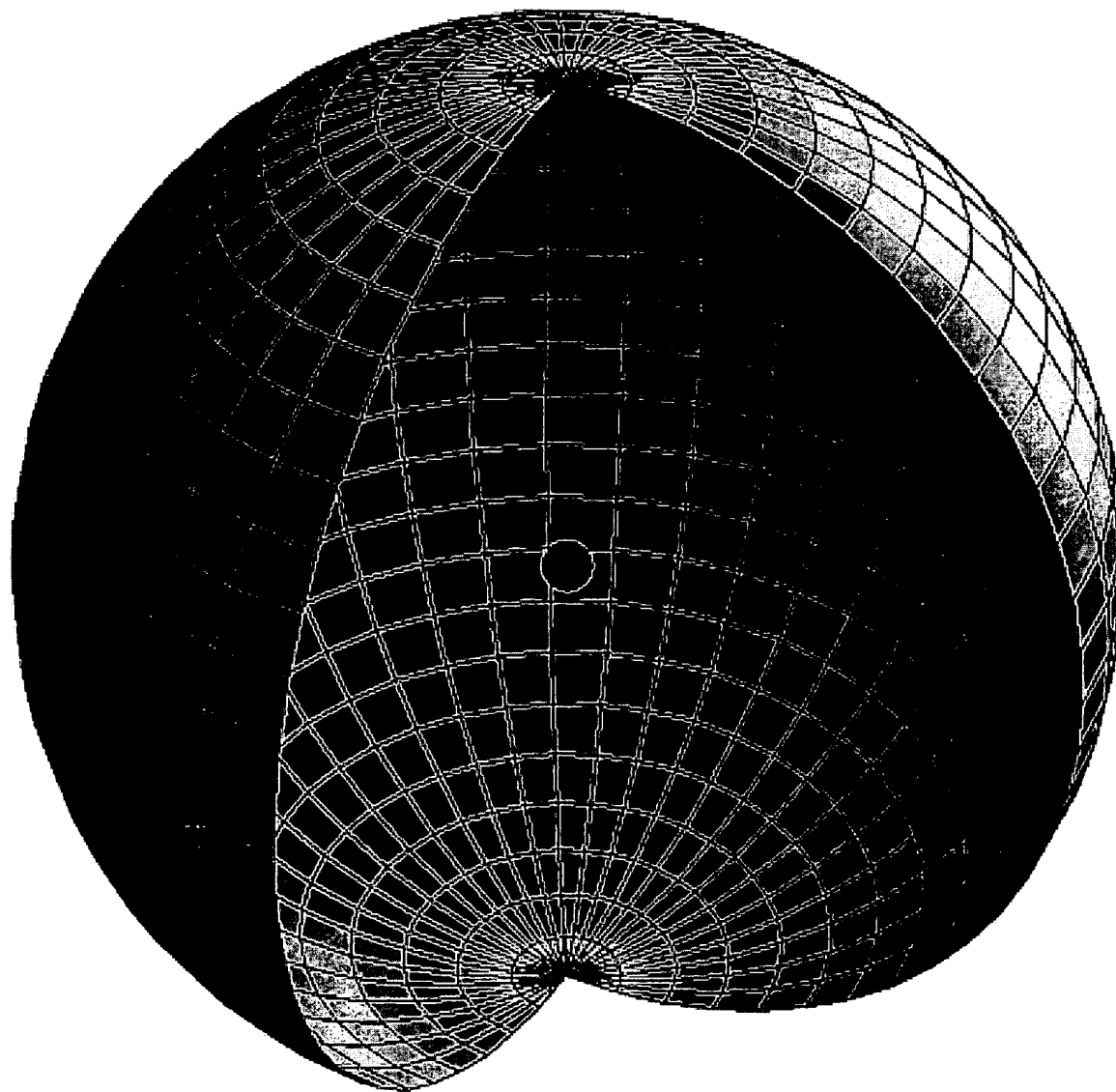
Figure. 3.1A. The angular-momentum-axis view of the magnitude of the continuous
mass (charge)-density function in the xy-plane of a polarized free electron
propagating along the z-axis and the side view of this electron. For the
polarized electron, the angular momentum axis is aligned along the direction of
propagation, the z-axis.

The Free Electron

$$\rho 0 = \frac{\hbar}{m_e \, v_z}$$

Angular
Momentum Axis

Angular
Momentum Axis
View

Side View

increasing electron density ⟶
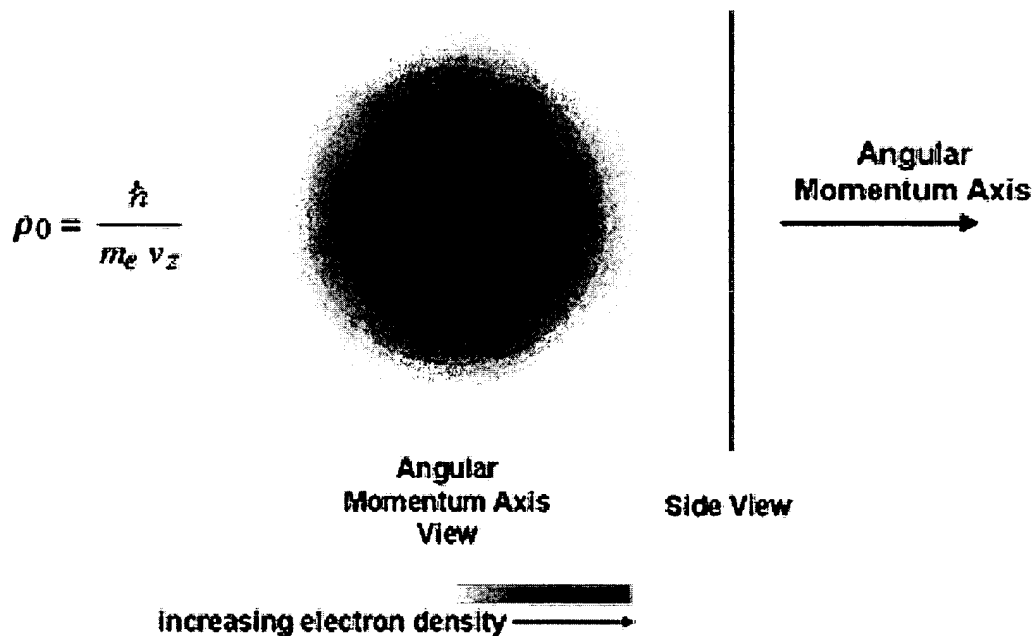
Animation and supporting visual aids are given at the following web site:

http://www.blacklightpower.com/theory/theory.shtml

Section 63

Examiner Souw further argues on page 18 of his Appendix:

(d) On pg.39, applicant presents new arguments that the Examiner takes issue
with as follows:

(1) Applicant's analysis based on Haus theorem is mathematically and physically
flawed, as already addressed in the previous Souw Appendix, to be again
repeated and emphasized in the following sections (i.e., mathematically,
regarding Applicant's "solution" of electron wave function p(r,t) based on the ä-

function that does not satisfy the wave equation; and physically, the non-applicability of Lorentz contraction formula to Applicant's orbiting electron).

The Examiner is stuck in his myopic view according to SQM that the electron must move in the radial direction and be a solution of the three-dimensional wave equation plus time. There is no a priori reason for this to be the case. If fact, it can't be. Since the electron is bound in an inverse-squared central field, any radial motion must result in a change in the angular momentum and the total energy of the electron. Since the total energy is constant (13.6 eV), this can not be the case. The radial Dirac delta function corresponds to the two-dimensional wave equation plus time. This wave equation gives the correct physics of constant energy and angular momentum and provides for the stability of the bound electron to radiation in accordance with Maxwell's equations. See, for example:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

As given in many instances, such as the Introduction of Mills GUT (Ref. #1):

CQM APPROACH TO THE SOLUTION OF THE ELECTRON

CQM solves the electron by a different approach than that used to solve the Schrödinger wave equation. Rather than using a postulated wave equation with time eliminated in terms of the energy of the electron in a Coulomb field and solving the charge wave (Schrödinger interpretation) or the probability wave (Born interpretation), the solution for the scalar (charge) and vector potential (current) functions of the electron are sought based on first principles. CQM first assumes that the functions that physically describe the mass and charge of the electron in space and time obey the wave equation since it conserves energy and angular momentum. The solution is initially generalized to be three dimensional plus time. Rather than use the postulated Schrödinger boundary condition: "$\Psi \to 0$ as $r \to \infty$", which leads to a purely mathematical model of the electron, the constraint is based on the experimental observation that the moving charge must not radiate. Application of the Haus' condition based on Maxwell's equations to a generalized three dimension plus time wave equation requires that the functions must be solutions of Eq. (I.16), a two dimensional wave equation plus time. This is consistent with first principle laws and ultimately matches experimentation. However, it is unconventional.

The two dimensional wave equation plus time is given by McQuarrie [2]. It is mathematically identical to the familiar rigid rotor equation of QM. The electron is confined to two dimensions (θ and ϕ) plus time, and the corresponding wave equation solution is called an electron orbitsphere. Spherical harmonic functions and time harmonic functions are well known solutions of the angular and time components of the two dimensional wave equation plus time, respectively. The solutions appear in McQuarrie [3]. A constant current function is also a solution of the wave equation. A constant function corresponding to the electron spin function is added to each of the spherical harmonic functions to give the charge (mass)-density functions of the electron as a function of time. The integral of a spherical harmonic function over the orbitsphere is zero. The integral of the constant function over the orbitsphere is the total charge (mass) of the electron. These functions comprise the well known s, p, d, f, etc. electrons or orbitals. In the case that such an electron state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current-density function since it possesses spacetime Fourier components synchronous with waves traveling at the speed of light as shown in the Instability of the Excited States section.

The excited states are solved including the radii of the orbitspheres using Maxwell's equations with the traditional source current boundary

constraints at the electron. Quantization arises from the equation of the photon and the electron—not from the solution of the electron alone. After all, each solution models an excited state created by the absorption of a photon. The solutions are analogous to those of excited resonator modes except that the cavity is dynamic. The field lines from the proton end on the current-density function of the electron, and the electric field is zero for $r > r_n$. The trapped photons are a solution of the three dimensional wave equation plus time given by Maxwell's equations. The electrodynamic field of the photon is a constant function plus a time and spherical harmonic function that is in phase with source currents at the electron which is given by a constant plus a time and spherical harmonic function. Only particular solutions are possible as resonant photons of the electron which is a dynamic resonator cavity. The results are in agreement with first principle physics and experimental observations of the hydrogen atom, excited states, free electron, and free space photon including the wave particle duality aspects.

SPIN AND ORBITAL PARAMETERS ARISE FROM FIRST PRINCIPLES

An electron is a spinning, two-dimensional spherical surface, called an *electron orbitsphere*, that can exist in a bound state only at specific radii r_n from the nucleus. (See Figure 1.1 for a pictorial representation of an orbitsphere.) The result for the $n = 1$ state of hydrogen is that the charge-density function remains constant with each point on the surface moving at the same angular and linear velocity. The constant function solution of the two dimensional wave equation corresponds to the spin function which has a corresponding spin angular momentum that may be calculated from $\mathbf{r} \times \mathbf{p}$ applied directly to the current-density function that describes the electron. The radius of the nonradiative ($n = 1$) state is solved using the electromagnetic force equations of Maxwell relating the charge and mass-density functions wherein the angular momentum of the electron is $\hbar$ (Eq. (1.165)). The reduced mass arises naturally from an electrodynamic interaction between the electron and the proton rather than from a point mass revolving around a point nucleus in the case of Schrödinger wave equation solutions which presents an internal inconsistency since the wave functions are spherically symmetrical.

CQM gives closed form solutions for the resonant photons and excited state electron functions. The free space photon also comprises a radial Dirac delta function, and the angular momentum of the photon given by $\mathbf{m} = \int \frac{1}{8\pi c} \mathrm{Re}[\mathbf{r} \times (\mathbf{E} \times \mathbf{B}^*)] dx^4 = \hbar$ in the Photon section is conserved for the solutions for the resonant photons and excited state electron functions. It can be demonstrated that the resonance condition between these frequencies is to be satisfied in order to have a net change of the energy field [4]. In the present case, the correspondence principle

holds. That is the change in angular frequency of the electron is equal to the angular frequency of the resonant photon that excites the resonator cavity mode corresponding to the transition, and the energy is given by Planck's equation. The predicted energies, Lamb shift, fine structure splitting, hyperfine structure, resonant line shape, line width, selection rules, etc. are in agreement with observation.

The radii of excited states are solved using the electromagnetic force equations of Maxwell relating the field from the charge of the proton, the electric field of the photon, and charge and mass-density functions of the electron wherein the angular momentum of the electron is $\hbar$ (Eq. (1.165)).

For excited states of the hydrogen atom, the constant function solution of the two dimensional wave equation corresponds to the spin function. Each spherical harmonic function modulates the constant spin function and corresponds to an orbital function of a specific excited state with a corresponding phase-matched trapped photon and orbital angular momentum. Thus, the spherical harmonic function behaves as a charge-density wave which travels time harmonically on the surface of the orbitsphere about a specific axis. (See Figure 1.2 for a pictorial representation.) The amplitude of the corresponding orbital energy may be calculated from Maxwell's equations. Since the constant function is modulated harmonically, the time average of the orbital energy is zero except in the presence of a magnetic field. Nondegeneracy of energy levels arises from spin, orbital, and spin-orbital coupling interactions with the applied field. The electrodynamic interaction with the magnetic field gives rise to the observed hyperfine splitting of the hydrogen spectrum.

Many inconsistencies arise in the case of the corresponding solutions of the Schrödinger wave equation. For example, where is the photon in excited states given by the Schrödinger equation? And, a paradox arises for the change in angular momentum due to photon absorption. The Schrödinger equation solutions for the kinetic energy of rotation K_{rot} is given by Eq. (10) of ref. [5] and the value of the electron angular momentum L for the state $Y_{lm}(\theta,\phi)$ is given by Eq. (11) of ref. [5]. They predict that the excited state rotational energy levels are nondegenerate as a function of the ℓ quantum number even in the absence of an applied magnetic field, and the predicted energy is over six orders of magnitude of the observed nondegenerate energy in the presence of a magnetic field. In the absence of a magnetic field, no preferred direction exists. In this case, the ℓ quantum number is a function of the orientation of the atom with respect to an arbitrary coordinate system. Therefore, the nondegeneracy is nonsensical and violates conservation of angular momentum of the photon.

In quantum mechanics, the spin angular momentum of the electron is called the "intrinsic angular momentum" since no physical interpretation exists. The Schrödinger equation is not Lorentzian invariant in violation of special relativity. It fails to predict the results of the Stern-Gerlach experiment which indicates the need for an additional quantum number. Quantum Electrodynamics (QED) was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. It is fatally flawed. From Weisskopf [6], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; 1.) DOES NOT EXPLAIN NONRADIATION OF BOUND ELECTRONS; 2.) contains an internal inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite (the Schrödinger equation fails to predict the classical electron radius); 3.) it admits solutions of negative rest mass and negative kinetic energy; 4.) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; 5.) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. Dirac's equation which was postulated to explain spin relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors. All of these features are untenable or are inconsistent with observation. These problems regarding spin and orbital angular momentum and energies and the classical electron radius are nonexistent with CQM solutions.

Furthermore, the mathematical relationship whereby the Schrödinger equation may be transformed into a form consistent with first principles is shown *infra*. In the case that the potential energy of the Hamiltonian, H, is a constant times the wavenumber, the Schrödinger equation is the well known Bessel equation. Then one of the solutions for the wavefunction Ψ (a current-density function rather than a probability wave) is equivalent to an inverse Fourier transform. According to the duality and scale change properties of Fourier transforms, the energy equation of CQM and that of quantum mechanics are identical, the energy of a radial Dirac delta function of radius equal to an integer multiple of the radius of the hydrogen atom.

CLASSICAL QUANTUM THEORY

One-electron atoms include the hydrogen atom, He^+, Li^{2+}, Be^{3+}, and so on. The mass-energy and angular momentum of the electron are constant; this requires that the equation of motion of the electron be temporally and spatially harmonic. Thus, the classical wave equation applies and

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]\rho(r,\theta,\phi,t) = 0 \qquad (1.2)$$

where $\rho(r,\theta,\phi,t)$ is the charge-density function of the electron in time and space. In general, the wave equation has an infinite number of solutions. To arrive at the solution which represents the electron, a suitable boundary condition must be imposed. It is well known from experiments that each single atomic electron of a given isotope radiates to the same stable state. Thus, CQM uses the physical boundary condition of nonradiation of the bound electron to be imposed on the solution of the wave equation for the charge-density function of the electron. The condition for radiation by a moving point charge given by Haus [7] is that its spacetime Fourier transform possesses components that are synchronous with waves traveling at the speed of light. Conversely, it is proposed that the condition for nonradiation by an ensemble of moving point charges that comprises a charge-density function is

For non-radiative states, the current-density function must NOT possess spacetime Fourier components that are synchronous with waves traveling at the speed of light.

The Haus derivation applies to a moving charge-density function as well because charge obeys superposition. The Haus derivation is summarized below.

The Fourier components of the current produced by the moving charge are derived. The electric field is found from the vector equation in Fourier space (**k**, ω-space). The inverse Fourier transform is carried over the magnitude of **k**. The resulting expression demonstrates that the radiation field is proportional to $\mathbf{J}_{\perp}(\frac{\omega}{c}\mathbf{n},\omega)$, where $\mathbf{J}_{\perp}(\mathbf{k},\omega)$ is the spacetime Fourier transform of the current perpendicular to **k** and $\mathbf{n} \equiv \frac{\mathbf{k}}{|k|}$. Specifically,

$$\mathbf{E}_{\perp}(\mathbf{r},\omega)\frac{d\omega}{2\pi} = \frac{c}{2\pi}\int\rho(\omega,\Omega)d\omega d\Omega\sqrt{\frac{\mu_0}{\varepsilon_0}}\,\mathbf{n}\,X\left(\mathbf{n}\,X\mathbf{J}_{\perp}\left(\frac{\omega}{c}\mathbf{n},\omega\right)e^{i\left(\frac{\omega}{c}\right)\mathbf{n}\cdot\mathbf{r}}\right) \qquad (1.3)$$

The field $\mathbf{E}_{\perp}(\mathbf{r},\omega)\frac{d\omega}{2\pi}$ is proportional to $\mathbf{J}_{\perp}\left(\frac{\omega}{c}\mathbf{n},\omega\right)$, namely, the Fourier component for which $\mathbf{k} = \frac{\omega}{c}$. Factors of ω that multiply the Fourier component of the current are due to the density of modes per unit volume and unit solid angle. An unaccelerated charge does not radiate in free space, not because it experiences no acceleration, but because it has no Fourier component $\mathbf{J}_{\perp}\left(\frac{\omega}{c}\mathbf{n},\omega\right)$. (Nonradiation is also shown directly using

Maxwell's equations in Appendix I: Nonradiation Based on the
Electromagnetic Fields and the Poynting Power Vector.)

The time, radial, and angular solutions of the wave equation are
separable. The motion is time harmonic with frequency ω_n. To be a
harmonic solution of the wave equation in spherical coordinates, the
angular functions must be spherical harmonic functions. A zero of the
spacetime Fourier transform of the product function of two spherical
harmonic angular functions, a time harmonic function, and an unknown
radial function is sought. The solution for the radial function which
satisfies the boundary condition is a delta function

$$f(r) = \frac{1}{r^2} \delta(r - r_n) \tag{I.4}$$

where $r_n = nr_1$ is an allowed radius. Thus, bound electrons are described
by a charge-density (mass-density) function which is the product of a
radial delta function ($f(r) = \frac{1}{r^2} \delta(r - r_n)$), two angular functions (spherical
harmonic functions), and a time harmonic function. Thus, an electron is a
spinning, two-dimensional spherical surface, called an *electron
orbitsphere*, that can exist in a bound state at only specified distances
from the nucleus as shown in Figure 1.1. More explicitly, the orbitsphere
comprises a two-dimensional spherical shell of moving charge.

The total function that describes the spinning motion of each
electron orbitsphere is composed of two functions. One function, the spin
function, is spatially uniform over the orbitsphere, spins with a quantized
angular velocity, and gives rise to spin angular momentum. The other
function, the modulation function, can be spatially uniform—in which case
there is no orbital angular momentum and the magnetic moment of the
electron orbitsphere is one Bohr magneton—or not spatially uniform—in
which case there is orbital angular momentum. The modulation function
also rotates with a quantized angular velocity.

The uniform current density function $Y_0^0(\phi, \theta)$, the orbitsphere
equation of motion of the electron (Eqs. (1.64-1.65)), corresponding to the
constant charge function of the orbitsphere that gives rise to the spin of
the electron is generated from a basis set current-vector field defined as
the orbitsphere current-vector field ("orbitsphere-cvf"). This in turn is
generated from orthogonal great circle current loops that serve as basis
elements. In Appendix III, the *continuous* uniform electron current density
function $Y_0^0(\phi, \theta)$ (Eqs. (1.64-1.65)) is then exactly generated from this
orbitsphere-cvf as a basis element by a convolution operator comprising
an autocorrelation-type function.

The orbitsphere-cvf comprises an infinite series of correlated
orthogonal great circle current loops. The current pattern is generated
over the surface by two sets of an infinite series of nested rotations of two

orthogonal great circle current loops where the coordinate axes rotate with the two orthogonal great circles. Each infinitesimal rotation of the infinite series is about the new i'-axis and new j'-axis which results from the preceding such rotation. For each of the two sets of nested rotations, the angular sum of the rotations about each rotating i'-axis and j'-axis totals $\frac{\sqrt{2}}{2}\pi$ radians.

Consider the electron to be evenly distributed within two sets of orthogonal great circle current loops for Steps One and Two. Then, consider two infinitesimal point mass (charge)-density elements, one and two, of one set of two orthogonal great circle current loops wherein initially the first current loop lies in the yz-plane, and the second current loop lies in the xz-plane. The xyz Cartesian coordinate frame is designated the laboratory reference frame. The algorithm to generate the orbitsphere-cvf rotates the great circles and the corresponding coordinates relative to the xyz frame. A primed Cartesian coordinate system refers to the axes that rotate with the great circles and determines the basis-set reference frame. Each element of the current pattern is obtained with each conjugate set of rotations. For Step One, consider two such infinitesimal charges (masses) at points one (moving counter clockwise on the great circle in the y'z'-plane) and two (moving clockwise on the great circle in the x'z'-plane) of two orthogonal great circle current loops in the basis frame are considered as sub-basis elements to generate the current density corresponding to the spin quantum number, $s = \frac{1}{2}$; $m_s = \pm\frac{1}{2}$. Initially element one is at $x' = 0$, $y' = 0$, and $z' = r_n$ and element two is at $x' = r_n$, $y' = 0$, and $z' = 0$ as shown in Figure 1.4A. The equations of motion, in the sub-basis-set reference frame are given by

point one:

$$x_1' = 0 \qquad y_1' = -r_n\sin(\omega_n t) \qquad z_1' = r_n\cos(\omega_n t) \qquad \text{(I.5a)}$$

point two:

$$x_2' = r_n\cos(\omega_n t) \qquad y_2' = 0 \qquad z_2' = r_n\sin(\omega_n t) \qquad \text{(I.5b)}$$

For Step Two, consider two charge (mass)-density elements, point one and two, in the basis-set reference frame at time zero. Element one is at $x' = 0$, $y' = r_n$, and $z' = 0$ and element two is at $x' = r_n$, $y' = 0$, and $z' = 0$. Let element one move clockwise on a great circle toward the -z'-axis as shown in Figure 1.4B, and let element two move counter clockwise on a great circle toward the y'-axis as shown in Figure 1.4B. The equations of motion, in the basis-set reference frame are given by

point one:

$$x_1' = 0 \qquad y_1' = r_n \cos(\omega_n t) \qquad z_1' = -r_n \sin(\omega_n t) \qquad \text{(I.6a)}$$

point two:

$$x_2' = r_n \cos(\omega_n t) \qquad y_2' = r_n \sin(\omega_n t) \qquad z_2' = 0 \qquad \text{(I.6b)}$$

The great circles are rotated by an infinitesimal angle $\pm\Delta\alpha_i$ (a rotation around the x'-axis or z'-axis for Steps One and Two, respectively) and then by $\pm\Delta\alpha_j$ (a rotation around the new y'-axis or x'-axis for Steps One and Two, respectively) where the rotation directions are shown in Figures 1.4A and 1.4B, respectively. The coordinates of each point on each rotated great circle (x',y',z') is expressed in terms of the first (x,y,z) coordinates by the following transforms where clockwise rotations are defined as positive:

Step One

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & 0 & -\sin(\Delta\alpha_y) \\ 0 & 1 & 0 \\ \sin(\Delta\alpha_y) & 0 & \cos(\Delta\alpha_y) \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & \sin(\Delta\alpha_y)\sin(\Delta\alpha_x) & -\sin(\Delta\alpha_y)\cos(\Delta\alpha_x) \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_y) & -\cos(\Delta\alpha_y)\sin(\Delta\alpha_x) & \cos(\Delta\alpha_y)\cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\text{(I.7)}$$

Step Two

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\sin(\Delta\alpha_z) & \cos(\Delta\alpha_z) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\cos(\Delta\alpha_x)\sin(\Delta\alpha_z) & \cos(\Delta\alpha_x)\cos(\Delta\alpha_z) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_x)\sin(\Delta\alpha_z) & -\sin(\Delta\alpha_x)\cos(\Delta\alpha_z) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

(I.8)

where the angular sum is $\displaystyle \lim_{\Delta\alpha \to 0} \sum_{n=1}^{\frac{\frac{\sqrt{2}}{2}\pi}{|\Delta\alpha_{i',j'}|}} |\Delta\alpha_{i',j'}| = \frac{\sqrt{2}}{2}\pi$.

The orbitsphere-cvf is given by n reiterations of Eqs. (I.7) and (I.8) for each point on each of the two orthogonal great circles during each of Steps One and Two where the sign of $\pm\Delta\alpha_i$ and $\pm\Delta\alpha_j$ for each Step are given in Table 1.1. The output given by the non-primed coordinates is the input of the next iteration corresponding to each successive nested rotation by the infinitesimal angle $\pm\Delta\alpha_i$ or $\pm\Delta\alpha_j$ where the magnitude of the angular sum of the n rotations about each of the i'-axis and the j'-axis is $\frac{\sqrt{2}}{2}\pi$. Half of the orbitsphere-cvf is generated during each of Steps One and Two.

Following Step Two, in order to match the boundary condition that the magnitude of the velocity at any given point on the surface is given by Eq. (1.56), the output half of the orbitsphere-cvf is rotated clockwise by an angle of $\frac{\pi}{4}$ about the z-axis. Using Eq. (I.8) with $\Delta\alpha_z = \frac{\pi}{4}$ and $\Delta\alpha_x = 0$ gives the rotation. Then, the one half of the orbitsphere-cvf generated from Step One is superimposed with the complementary half obtained from Step Two following its rotation about the z-axis of $\frac{\pi}{4}$ to give the orbitsphere-cvf.

The current pattern of the orbitsphere-cvf generated by the nested rotations of the orthogonal great circle current loops is a continuous and

total coverage of the spherical surface, but it is shown as visual representations using 6 degree increments of the infinitesimal angular variable $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ of Eqs. (I.7) and (I.8) from six perspectives in Figures 1.5A-F. In each case, the complete orbitsphere-cvf current pattern corresponds to all the correlated points, points one and two, of the orthogonal great circles shown in Figures 1.4A and 1.4B which are rotated according to Eqs. (I.7) and (I.8) where $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ approach zero and the summation of the infinitesimal angular rotations of $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ about the successive i'-axes and j'-axes is $\dfrac{\sqrt{2}}{2}\pi$ for each Step. The current pattern gives rise to the phenomenon corresponding to the spin quantum number.

The resultant angular momentum projections of $\mathbf{L}_{xy} = \dfrac{\hbar}{4}$ and $\mathbf{L}_z = \dfrac{\hbar}{2}$ meet the boundary condition for the unique current having an angular velocity magnitude at each point on the surface given by Eq. (1.56) and give rise to the Stern Gerlach experiment as shown in the Magnetic Parameters of the Electron (Bohr Magneton) section, and in the Electron g Factor section. The further constraint that the current density is uniform such that the charge density is uniform, corresponding to an equipotential, minimum energy surface is satisfied by using the orbitsphere-cvf as a basis element to generate $Y_0^0(\phi,\theta)$ using a convolution operator comprising an autocorrelation-type function as given in Appendix III. The operator comprises the convolution of each great circle current loop of the orbitsphere-cvf designated as the primary orbitsphere-cvf with a second orbitsphere-cvf designated as the secondary orbitsphere-cvf.

The orbitsphere-cvf comprises two components corresponding to each of STEP ONE and STEP TWO. As shown for STEP TWO, the angular momentum vector is stationary on the $\left(-\dfrac{1}{\sqrt{2}}\mathbf{i}_x, \dfrac{1}{\sqrt{2}}\mathbf{i}_y, \mathbf{i}_z\right)$-axis as the component orbitsphere-cvf is generated by the series of nested rotations using Eq. (1.70b). It is shown in Appendix III that STEP TWO can also be generated by a 2π-rotation of a single basis-element current loop about the $\left(-\dfrac{1}{\sqrt{2}}\mathbf{i}_x, \dfrac{1}{\sqrt{2}}\mathbf{i}_y, \mathbf{i}_z\right)$-axis. In the general case that the resultant angular momentum of each pair of orthogonal great circle current loops of the component orbitsphere-cvf is along the 2π-rotational axis (defined as the rotational axis which generates the component orbitsphere-cvf from a basis-element great circle), a secondary nth component orbitsphere-cvf can serve as a basis element to match the angular momentum of any given nth great circle of a primary component orbitsphere-cvf. The replacement of each great circle of the primary orbitsphere-cvf with a secondary orbitsphere-cvf of matching angular momentum, orientation,

and phase comprises an autocorrelation-type function that exactly gives rise to the spherically-symmetric current density, $Y_0^0(\phi, \theta)$, as the sum of two uniform spherical contributions from each component. The resulting exact uniform current distribution obtained from the convolution has the same angular momentum distribution, resultant, $\mathbf{L_R}$, and components of $\mathbf{L}_{xy} = \dfrac{\hbar}{4}$ and $\mathbf{L}_z = \dfrac{\hbar}{2}$ as those of the orbitsphere-cvf used as a primary basis element.

In contrast to the QM and QED cases (See Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality), the fourth quantum number arises naturally in CQM as derived in the Electron g Factor section. The Stern-Gerlach experiment implies a magnetic moment of one Bohr magneton and an associated angular momentum quantum number of 1/2. Historically, this quantum number is called the spin quantum number, s ($s = \dfrac{1}{2}$; $m_s = \pm\dfrac{1}{2}$). Conservation of angular momentum of the orbitsphere permits a discrete change of its "kinetic angular momentum" ($\mathbf{r} \times m\mathbf{v}$) with respect to the field of $\dfrac{\hbar}{2}$, and concomitantly the "potential angular momentum" ($\mathbf{r} \times e\mathbf{A}$) must change by $-\dfrac{\hbar}{2}$. The flux change, ϕ, of the orbitsphere for $r < r_n$ is determined as follows:

$$\Delta \mathbf{L} = \frac{\hbar}{2} - \mathbf{r} \times e\mathbf{A} \tag{I.9}$$

$$= \left[\frac{\hbar}{2} - \frac{e2\pi r A}{2\pi} \right]\hat{z} \tag{I.10}$$

$$= \left[\frac{\hbar}{2} - \frac{e\phi}{2\pi} \right]\hat{z} \tag{I.11}$$

In order that the change of angular momentum, $\Delta \mathbf{L}$, equals zero, ϕ must be $\Phi_0 = \dfrac{h}{2e}$, the magnetic flux quantum. Thus, to conserve angular momentum in the presence of an applied magnetic field, the orbitsphere magnetic moment can be parallel or antiparallel to an applied field as observed with the Stern-Gerlach experiment, and the flip between orientations is accompanied by the "capture" of the magnetic flux quantum by the orbitsphere. During the spin-flip transition, power must be conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \bullet (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o\mathbf{H} \bullet \mathbf{H}\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o\mathbf{E} \bullet \mathbf{E}\right] - \mathbf{J} \bullet \mathbf{E} \tag{I.12}$$

Eq. (I.13) derived in the Electron g Factor section gives the total energy of the flip transition which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric

energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively.

$$\Delta E_{mag}^{spin} = 2\left(1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2\right)\mu_B B \qquad (\text{I.13})$$

$$\Delta E_{mag}^{spin} = g\mu_B B \qquad (\text{I.14})$$

The spin-flip transition can be considered as involving a magnetic moment of g times that of a Bohr magneton. The g factor is redesignated the fluxon g factor as opposed to the anomalous g factor. The calculated value of $\frac{g}{2}$ is $1.001\ 159\ 652\ 137$. The experimental value [8] of $\frac{g}{2}$ is $1.001\ 159\ 652\ 188(4)$.

CQM solves the wave equation for the charge-density function of the electron. The time, radial, and angular solutions of the wave equation are separable. Also, the radial function for the electron indicates that the electron is two-dimensional. Therefore, the angular mass-density function of the electron, $A(\theta,\phi,t)$, must be a solution of the wave equation in two dimensions (plus time). EQ. (I.2) becomes

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]A(\theta,\phi,t) = 0 \qquad (\text{I.15})$$

where $\rho(r,\theta,\phi,t) = f(r)A(\theta,\phi,t) = \frac{1}{r^2}\delta(r-r_n)A(\theta,\phi,t)$ and

$A(\theta,\phi,t) = Y(\theta,\phi)k(t)$. Specifically, the wave equation is

$$\left[\frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial}{\partial\theta}\right)_{r,\phi} + \frac{1}{r^2\sin^2\theta}\left(\frac{\partial^2}{\partial\phi^2}\right)_{r,\theta} - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]A(\theta,\phi,t) = 0 \quad (\text{I.16})$$

where v is the linear velocity of the electron. The charge-density functions including the time-function factor are

$\ell = 0$

$$\rho(r,\theta,\phi,t) = \frac{e}{8\pi r^2}[\delta(r-r_n)]\left[Y_0^0(\theta,\phi) + Y_\ell^m(\theta,\phi)\right] \qquad (\text{I.17})$$

$\ell \neq 0$

$$\rho(r,\theta,\phi,t) = \frac{e}{4\pi r^2}[\delta(r-r_n)]\left[Y_0^0(\theta,\phi) + \mathrm{Re}\left\{Y_\ell^m(\theta,\phi)e^{i\omega_n t}\right\}\right] \qquad (\text{I.18})$$

where $\mathrm{Re}\left\{Y_\ell^m(\theta,\phi)e^{i\omega_n t}\right\} = P_\ell^m(\cos\theta)\cos(m\phi + \omega_n' t)$ and to keep the form of the spherical harmonic as a traveling wave about the z-axis, $\omega_n' = m\omega_n$.

The spin function of the electron (see Figure 1.1 for the charge function and Figure 1.5A for the current function) corresponds to the nonradiative $n = 1$, $\ell = 0$ state of atomic hydrogen which is well known as an s state or orbital. The constant spin function is modulated by a time and spherical harmonic function as given by Eq. (I.18) and shown in

Figure 1.2. The modulation or traveling charge-density wave corresponds to an orbital angular momentum in addition to a spin angular momentum. These states are typically referred to as p, d, f, etc. orbitals and correspond to an ℓ quantum number not equal to zero. Application of the condition from Haus [7] (Eqs, (I.19-I.21)) also predicts nonradiation for a constant spin function modulated by a time and spherically harmonic orbital function. There is acceleration without radiation. (Also see Abbott and Griffiths and Goedecke [9-10]). Nonradiation is also shown directly using Maxwell's equations in Appendix I: Nonradiation Based on the Electromagnetic Fields and the Poynting Power Vector. However, in the case that such a state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current-density function since it possesses spacetime Fourier transform components synchronous with waves traveling at the speed of light as shown in the Instability of Excited States section.

The Fourier transform of the electron charge-density function is a solution of the four-dimensional wave equation in frequency space (**k**, ω-space). Then the corresponding Fourier transform of the current-density function $K(s,\Theta,\Phi,\omega)$ is given by multiplying by the constant angular frequency.

$$K(s,\Theta,\Phi,\omega) = 4\pi\omega_n \frac{\sin(2s_n r_n)}{2s_n r_n} \otimes 2\pi \sum_{\upsilon=1}^{\infty} \frac{(-1)^{\upsilon-1}(\pi\sin\Theta)^{2(\upsilon-1)}}{(\upsilon-1)!(\upsilon-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(\upsilon+\frac{1}{2}\right)}{(\pi\cos\Theta)^{2\upsilon+1}2^{\upsilon+1}} \frac{2\upsilon!}{(\upsilon-1)!} s^{-2\upsilon}$$

$$\otimes 2\pi \sum_{\upsilon=1}^{\infty} \frac{(-1)^{\upsilon-1}(\pi\sin\Phi)^{2(\upsilon-1)}}{(\upsilon-1)!(\upsilon-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(\upsilon+\frac{1}{2}\right)}{(\pi\cos\Phi)^{2\upsilon+1}2^{\upsilon+1}} \frac{2\upsilon!}{(\upsilon-1)!} s^{-2\upsilon} \frac{1}{4\pi}[\delta(\omega-\omega_n)+\delta(\omega+\omega_n)]$$

(I.19)

The motion on the orbitsphere is angular; however, a radial component exists due to special relativistic effects. Consider the radial wave vector of the sinc function. When the radial projection of the velocity is c

$$\mathbf{s}_n \bullet \mathbf{v}_n = \mathbf{s}_n \bullet \mathbf{c} = \omega_n$$

(I.20)

the relativistically corrected wavelength is

$$r_n = \lambda_n$$

(I.21)

(i.e. the lab frame motion in the angular direction goes to zero as the velocity approaches the speed of light). Substitution of Eq. (I.21) into the sinc function results in the vanishing of the entire Fourier transform of the current-density function. Thus, spacetime harmonics of $\dfrac{\omega_n}{c} = k$ or

$$\frac{\omega_n}{c}\sqrt{\frac{\varepsilon}{\varepsilon_o}} = k$$ for which the Fourier transform of the current-density function

is nonzero do not exist. Radiation due to charge motion does not occur in any medium when this boundary condition is met.

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Section 64

Examiner Souw further demonstrates a disturbing lack of understanding of Applicant's disclosed invention with his statements on pages 18-19 of the Appendix that:

> (2) Applicant's allegation that QM is inconsistent with experimental observation is doubly flawed. Firstly, the fact that hydrogen ground state (n=1) does not radiate is confirmed by experimental observations without a single exception, as already recited in the previous Appendix. Secondly, Applicant's insistence that the n=1 state *does radiate* is not supported by any valid experimental evidence. Applicant's own "experimental evidence" (if any) must be disqualified, because it can not be confirmed by any independent third party researcher.

Applicant agrees with the Examiner's statement that "the fact that hydrogen ground state (n=1) does not radiate is confirmed by experimental observations without a single exception". Applicant uses this as the basis to solve the hydrogen atom rather than using a purely mathematical boundary condition as in the case of SQM, as discussed in Section 63 above.

Applicant, however, does not agree with the Examiner's further statement regarding "Applicant's insistence that the n=1 state *does radiate*." That statement proves that the Examiner does not have even a basic understanding of Applicant's disclosed invention. The patent specification, Applicant's 112 publications, as well as some of the papers from the section entitled "Independent Test Results" disclose the resonant, **nonradiative** energy transfer from the hydrogen atom to the catalyst. For example, from:

> 67. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.

> The elimination of known explanations indicate a new result. Since the novel peaks were only observed with helium and hydrogen present, new hydrogen, helium, or helium-hydrogen species are possibilities. It is well known that empirically the excited energy states of atomic hydrogen are given by Rydberg equation (Eq. (2a) for $n > 1$ in Eq. (2b)).

$$E_n = -\frac{e^2}{n^2 8\pi\varepsilon_o a_H} = -\frac{13.598\ eV}{n^2} \tag{2a}$$

$$n = 1,2,3,... \tag{2b}$$

> The $n = 1$ state is the "ground" state for "pure" photon transitions (i.e. the $n = 1$ state can absorb a photon and go to an excited electronic state, but it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a resonant nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common [47]. Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling [48].
> We propose that atomic hydrogen may undergo a catalytic reaction with certain atoms and ions such as He^+ which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2\ eV$ wherein m is an integer. The theory was given previously [49]. The reaction involves a nonradiative energy transfer to form a hydrogen atom

that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is
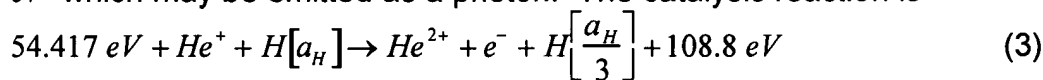
$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer}; \quad p \leq 137 \tag{2c}$$

replaces the well known parameter $n =$ integer in the Rydberg equation for hydrogen excited states. Thus, the Rydberg states are extended to lower levels as depicted in Figure 9. The $n = 1$ state of hydrogen and the
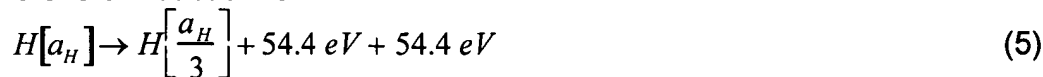
$n = \dfrac{1}{\text{integer}}$ states of hydrogen are nonradiative, but a transition between

two nonradiative states is possible via a nonradiative energy transfer, say $n = 1$ to $n = 1/2$. Thus, a catalyst provides a net positive enthalpy of reaction of $m \cdot 27.2 \ eV$ (i.e. it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

The novel peaks fit two empirical relationships. In order of energy, the set comprising the peaks at $91.2 \ nm$, $45.6 \ nm$, $30.4 \ nm$, $13.03 \ nm$, $10.13 \ nm$, and $8.29 \ nm$ correspond to energies of $q \cdot 13.6 \ eV$ where $q = 1,2,3,7,9,11$. In order of energy, the set comprising the peaks at $37.4 \ nm$, $20.5 \ nm$, and $14.15 \ nm$ correspond to energies of $q \cdot 13.6 - 21.21 \ eV$ where $q = 4,6,8$. These lines can be explained as electronic transitions to fractional Rydberg states of atomic hydrogen given by Eqs. (2a) and (2c) wherein the catalytic system involves helium ions because the second ionization energy of helium is $54.417 \ eV$, which is equivalent to $2 \cdot 27.2 \ eV$. In this case, $54.417 \ eV$ is transferred nonradiatively from atomic hydrogen to He^+ which is resonantly ionized. The electron decays to the $n = 1/3$ state with the further release of $54.417 \ eV$ which may be emitted as a photon. The catalysis reaction is
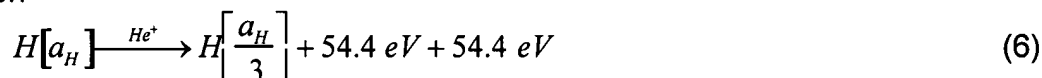
$$54.417 \ eV + He^+ + H[a_H] \rightarrow He^{2+} + e^- + H\left[\frac{a_H}{3}\right] + 108.8 \ eV \tag{3}$$

$$He^{2+} + e^- \rightarrow He^+ + 54.417 \ eV \tag{4}$$

And, the overall reaction is

$$H[a_H] \rightarrow H\left[\frac{a_H}{3}\right] + 54.4 \ eV + 54.4 \ eV \tag{5}$$

Since the products of the catalysis reaction have binding energies of $m \cdot 27.2 \ eV$, they may further serve as catalysts. Thus, further catalytic transitions may occur: $n = \dfrac{1}{3} \rightarrow \dfrac{1}{4}, \dfrac{1}{4} \rightarrow \dfrac{1}{5}$, and so on.

Electronic transitions to Rydberg states given by Eqs. (2a) and (2c) catalyzed by the resonant nonradiative transfer of $m \cdot 27.2 \ eV$ would give rise to a series of emission lines of energies $q \cdot 13.6 \ eV$ where q is an integer. It is further proposed that the photons that arise from hydrogen

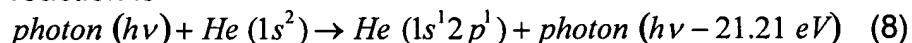transitions may undergo inelastic helium scattering. That is, the catalytic reaction

$$H[a_H] \xrightarrow{He^*} H\left[\frac{a_H}{3}\right] + 54.4 \ eV + 54.4 \ eV \tag{6}$$

yields $54.4 \ eV$ by Eq. (4) and a photon of $54.4 \ eV$ ($22.8 \ nm$). Once emitted, the photon may be absorbed or scattered. When this photon strikes $He \ (1s^2)$, $21.2 \ eV$ may be absorbed in the excitation to $He \ (1s^1 2p^1)$. This leaves a $33.19 \ eV$ ($37.4 \ nm$) photon peak and a $21.21 \ eV$ ($58.4 \ nm$) photon from $He \ (1s^1 2p^1)$. Thus, for helium the inelastic scattered peak of $54.4 \ eV$ photons from Eq. (3) is given by

$$E = 54.4 \ eV - 21.21 \ eV = 33.19 \ eV \ (37.4 \ nm) \tag{7}$$

A novel peak shown in Figures 2-4 was observed at $37.4 \ nm$. Furthermore, the intensity of the $58.4 \ nm$ peak corresponding to the spectra shown in Figure 4 was about 60,000 photons/sec. Thus, the transition $He \ (1s^2) \rightarrow He \ (1s^1 2p^1)$ dominated the inelastic scattering of EUV peaks. The general reaction is

$$photon \ (h\nu) + He \ (1s^2) \rightarrow He \ (1s^1 2p^1) + photon \ (h\nu - 21.21 \ eV) \tag{8}$$

The two empirical series may be combined—one directly from Eqs. (2a, 2c) and the other indirectly with Eq. (8). The energies for the novel lines in order of energy are $13.6 \ eV$, $27.2 \ eV$, $40.8 \ eV$, $54.4 \ eV$, $81.6 \ eV$, $95.2 \ eV$, $108.8 \ eV$, $122.4 \ eV$ and $149.6 \ eV$. The corresponding peaks are $91.2 \ nm$, $45.6 \ nm$, $30.4 \ nm$, $37.4 \ nm$, $20.5 \ nm$, $13.03 \ nm$, $14.15 \ nm$, $10.13 \ nm$, and $8.29 \ nm$, respectively. Thus, the identified novel lines correspond to energies of $q \cdot 13.6 \ eV$, $q = 1,2,3,7,9,11$. or $q \cdot 13.6 \ eV$, $q = 4,6,8$ less $21.2 \ eV$ corresponding to inelastic scattering of these photons by helium atoms due to excitation of $He \ (1s^2)$ to $He \ (1s^1 2p^1)$. The values of q observed are consistent with those expected based on Eq. (5) and the subsequent autocatalyzed reactions as discussed previously [50]. The broad satellite peak at $44.2 \ nm$ show in Figure 2-4 is consistent with the reaction mechanism of a nonradiative transfer to a catalyst followed by emission. There is remarkable agreement between the data and the proposed transitions to fractional Rydberg states and these lines inelastically scattered by helium according to Eq. (8). All other peaks could be assigned to He I, He II, second order lines, or atomic or molecular hydrogen emission. No known lines of helium or hydrogen explain the $q \cdot 13.6 \ eV$ related set of peaks.

The above data disqualifies the Examiner's further statement regarding lack of support by "any valid experimental evidence." The body of evidence that experimentally confirms hydrino is overwhelming and has been extensively validated as given in the Experimental sections of this Response.

Section 65

Examiner Souw further asserts on page 19 of this Appendix that:

(3) Applicant's arguments based on Laloë's article [5] are unpersuasive for reasons to be discussed in a section 6, sub-paragraph (d) below.

It is the Examiners arguments that are unpersuasive and prove that SQM is not based on physical laws. In fact, the Laloë's article demonstrates that it is hard to agree on what SQM is based on anything other than a belief system founded on postulates that gives rise to scenarios and consequences that are in contradiction with physical laws.

Section 66

On page 19 of his Appendix, Examiner Souw again improperly dismisses Applicant's scientific evidence, stating:

(4) Reference [80] is to be disqualified, since it is written by Applicant based on his own flawed theory which has been addressed numerous times by the Examiner.

Other theoreticians, such as those at Princeton University, agree with Applicant's arguments given in [80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted] that the Heisenberg Uncertainty Principle provides no atomic stability [E. H. Lieb, "The stability of matter", Reviews of Modern Physics, Vol. 48, No. 4, (1976), pp, 553-569].

Section 67

Examiner Souw commits additional errors in his statement on page 19 of the Appendix that:

(5) The proof given by Feynman that has removed the problem of self-radiation in an orbiting electron by virtue of the Heisenberg Uncertainty Principle (HUP) is scientifically convincing and well-accepted by the scientific community, while having been also independently confirmed based on exactly the same reason by the Examiner in the previous Appendix (same section 2, pg.2, lines 1-10; see also sect. 2.c above). This means, the scientific community generally agrees with Feynman and the Examiner, but disagrees with Applicant.

This is NOT TRUE. Lieb [34] also addresses the fact that the Schrödinger equation has been accepted for over a half of a century without addressing the stability of matter. Lieb also shows that the Feynman argument is "false" due to an inappropriate application of the Heisenberg Uncertainty Principle and admonishes the misrepresentation in textbooks. By considering a wavefunction comprised of two components at two radii such that the electron can not have both sharply defined momentum and position in accordance with the Uncertainty Principle, Lieb shows that the radius can be arbitrarily small including zero such that the energy is negative infinity. This result is obviously not predictive of stability.

Furthermore, the approach by Feynman and Lieb are physically baseless. Attempts to prove that a system has a kinetic energy that exceeds some lower bound such that the total energy is not negative infinity is not based on physics since it ignores radiation-loss terms. More recently, Bugliaro at al. [35] have attempted to use QED to prove the stability of matter with N nonrelativistic electrons and K static nuclei of nuclear charge $\leq Ze$ that can interact with photons. Here, the problem is "rigged" since the radiation field is defined to be quantized, an ultraviolet cutoff is arbitrarily imposed, Maxwell's equations are not obeyed due to the defined properties of the polarizations, and creation and annihilation operators including the limitation of the couplings of photons to electrons via Pauli operators only. Furthermore, the proof has nothing to do with the solutions of the actual atomic energy levels. Even then, stability is only found for a nuclear charge $Z \leq 6$. Thus, it is evident that neither the Schrödinger equation, variants thereof, or QED provide a general, self consistent, rigorous, and physical basis for the stability of matter.

34. E. H. Lieb, "The stability of matter", Reviews of Modern Physics, Vol. 48, No. 4, (1976), pp, 553-569.
35. L. Bugliaro, J. Fröhlich, G. M. Graf, "Stability of quantum electrodynamics with nonrelativistic matter", Physical Review Letters, Vol. 77, No. 17, (1996), pp. 3494-3497.

Section 68

Examiner Souw adds to the list of inconsistent position he has taken with the following statements on page 19 of the Appendix:

3. Regarding the alleged instability of the (excited) states

Applicant does not adequately address the Examiner's refutation as recited in the previous Appendix, but keeps repeating and insisting the correctness of his Grand Unified Theory (GUT). Applicant misunderstands the QM by sticking to the viewpoint of classical physics, instead of properly reconciling both viewpoints under the correspondence principle. Applicant's misinterpretation of "stationary states" in QM has been adequately described previously.

Particularly troubling is the Examiner's statement that, "Applicant misunderstands the QM by sticking to the viewpoint of classical physics, instead of properly reconciling both viewpoints under the correspondence principle." The Examiner contradicts himself by stating the SQM is based on physical laws, then argues on the other side that Applicant's use of physical laws is not correct according to SQM. Rather, it is the correspondence principle (CP) that is incorrect. The basis of the CP is that physical laws do not apply to atomic-size objects, but SQM must be consistent with physical laws as the scale increases. Then, what applies in the transition, and on what scale? There are no answers to these questions under SQM, which demonstrates why that it is not a valid theory of nature.

The nonzero instantaneous velocity (the particle does move according to the Examiner) requires that the point electron of SQM must radiate, as discussed under sections dealing with the Feynman-instability argument.

What is even more troubling when considering the Examiner's insistence that the n=1 state is stationary, yet it is moving, is that the electron of zero volume would have to travel at infinite velocity and "know" how to cover all trajectories to perfectly cover the space of the wave function for n=1. Yet, to would have to do this in one period given by 13.6 eV/h, not radiate, maintain a constant energy and angular momentum, always have a relativistically invariant magnetic moment of a Bohr magneton, be electrically neutral, give rise to the Stern Gerlach result including the g factor (know to about 14 significant figures), wherein the g factor determination must be an identical value upon measurement at any time, etc. It is easy to appreciate that this view collapses on its absurdity.

Section 69

Examiner Souw errs yet again in making the following statement taken from pages 19-20 of the Appendix:

> As recited in the previous Appendix, Applicant's formulas (1.59) to (1.68), as well as Eq. (1) to (5) on pg.44-45, are mathematically flawed and physically incorrect, not only with regard to QM, but also with respect to (Maxwell's) electrodynamics and Einstein's relativity theory, as already described in the previous Appendix and in Sect. 10 below.

The Examiner's error is confirmed by other physicists, such as those who provided the reviews given in Section 54 above. The correctness of the equations and special relativistic theory is evident in the closed-formed equations having fundamental constants only that give 100's of predictions that match the experimental values with remarkable agreement. These results can not be matched by SQM. See:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

Abstracts of specific examples are:

102. **R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", Physics Essays, submitted.**

It is true that the Schrödinger equation can be solved exactly for the hydrogen atom; although, it is not true that the result is the exact solution of the hydrogen atom. Electron spin is missed entirely, and there are many internal inconsistencies and nonphysical consequences that do not agree with experimental results. The Dirac equation does not reconcile this situation. Many additional shortcomings arise such as instability to radiation, negative kinetic energy states, intractable infinities, virtual particles at every point in space, the Klein paradox, violation of Einstein causality, and "spooky" action at a distance. Despite its successes, quantum mechanics (QM) has remained mysterious to all who have encountered it. Starting with Bohr and progressing into the present, the departure from intuitive, physical reality has widened. The connection between quantum mechanics and reality is more than just a "philosophical" issue. It reveals that quantum mechanics is not a correct or complete theory of the physical world and that inescapable internal inconsistencies and incongruities arise when attempts are made to treat it as a physical as opposed to a purely mathematical "tool". Some of these issues are discussed in a review by Laloë [1]. But, QM has severe limitations even as a tool. Beyond one-electron atoms, multielectron-atom quantum mechanical equations can not be solved except by approximation methods involving adjustable-parameter theories (perturbation theory, variational methods, self-consistent field method, multi-configuration Hartree Fock method, multi-configuration parametric potential method, $1/Z$ expansion method, multi-configuration Dirac-Fock method, electron correlation terms, QED terms, etc.)—all of which contain assumptions that can not be physically tested and are not consistent with physical laws. In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of e^- moving in the Coulombic field of the proton and the wave equation as modified by Schrödinger, a classical approach was explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level [2-4]. Physical laws and intuition are restored when dealing with the wave equation and quantum mechanical problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles that successfully applies physical laws on all scales. Rather than use the postulated Schrödinger boundary condition: "$\Psi \rightarrow 0$ as $r \rightarrow \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$-state electron cannot radiate energy*. The electron must be extended rather than a point. On this basis with the assumption that physical laws including Maxwell's equation apply to bound electrons, the

hydrogen atom was solved exactly from first principles. The remarkable agreement across the spectrum of experimental results indicates that this is the correct model of the hydrogen atom. In this paper, the physical approach was applied to multielectron atoms that were solved exactly disproving the deep-seated view that such exact solutions can not exist according to quantum mechanics. The general solutions for one through twenty-electron atoms are given. The predictions are in remarkable agreement with the experimental values known for 400 atoms and ions.

106. **R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Foundation Louis de Broglie, submitted.**

Quantum mechanics (QM) and quantum electrodynamics (QED) are often touted as the most successful theories ever. In this paper, this claim is critically evaluated by a test of internal consistency for the ability to calculate the conjugate observables of the nature of the free electron, ionization energy, elastic electron scattering, and the excited states of the helium atom using the same solution for each of the separate experimental measurements. It is found that in some cases quantum gives good numbers, but the solutions are meaningless numbers since each has no relationship to providing an accurate physical model. Rather, the goal is to mathematically reproduce an experimental or prior theoretical number using adjustable parameters including arbitrary wave functions in computer algorithms with precision that is often much greater (e.g. 8 significant figures greater) than possible based on the propagation of errors in the measured fundamental constants implicit in the physical problem. Given the constraints of adherence to physical laws and internal consistency, an extensive literature search indicates that quantum mechanics has never solved a single physical problem correctly including the hydrogen atom and the next member of the periodic chart, the helium atom. Rather than using postulated unverifiable theories that treat atomic particles as if they were not real, physical laws are now applied to the same problem. In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, a classical approach is explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level. The proverbial view deeply seated in the wave-particle duality notion that there is no large-scale physical counterpart to the nature of the electron is shown not to be correct. Physical laws and intuition may be restored when dealing with the wave equation and quantum atomic problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles as reported previously

[1-6] that successfully applies physical laws to the solution of atomic problems that has its basis in a breakthrough in the understanding of the stability of the bound electron to radiation. Rather than using the postulated Schrödinger boundary condition: "$\Psi \to 0$ as $r \to \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$- state electron cannot radiate energy.* Although it is well known that an accelerated *point* particle radiates, an *extended distribution* modeled as a superposition of accelerating charges does not have to radiate. A simple invariant physical model arises naturally wherein the predicted results are extremely straightforward and internally consistent requiring minimal math as in the case of the most famous equations of Newton, Maxwell, Einstein, de Broglie, and Planck on which the model is based. No new physics is needed; only the known physical laws based on direct observation are used. The accurate solution of the helium atom is confirmed by the agreement of predicted and observed conjugate parameters using the same unique physical model in all cases.

For examples of the successes of the relativistic theory of CQM, see Section 55 above and the paper:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics essays, submitted.

The claim that quantum electrodynamics (QED) is the most successful theory in history is critically evaluated. The Dirac equation was postulated in 1926 as a means to remedy the nonrelativistic nature of the Schrödinger equation to provide the missed fourth quantum number. The positive as well as negative square root terms provided an argument for the existence of negative energy states of the vacuum, virtual particles, and corresponding so-called quantum electrodynamics (QED) computer algorithms for calculating unexpected observables such as the Lamb shift and the anomalous magnetic moment of the electron. It is true that is possible to calculate to a high degree of precision the very small correction to the classical magnetic moment of a point-particle electron using QED, but it is at the expense of any reasonable or verifiable physics. The method relies on a string of far-fetched and unverifiable or disproved assumptions such as (1) infinite electric and magnetic fields that are arbitrarily normalized, (2) a "zoo" of infinite numbers of virtual particles at every point in space, (3) polarization of the vacuum by the proposed virtual particles, (4) postulated participation of the members of the zoo in myriad schemes to cause the so-called polarization, (5) the contribution from each such scheme corresponds to a coefficient based on the product of ratio of the mass of the virtual particle to that of the real

particle being experimentally observed and α/π, and (6) the schemes can be arbitrarily truncated to avoid further infinities. Due to the lack of rigor and a physical basis, QED calculations are argued to be meaningless. In a broader sense, the connection between the underlying quantum mechanics and reality is more than just a "philosophical" issue. It reveals that quantum mechanics is not a correct or complete theory of the physical world and that inescapable internal inconsistencies and incongruities arise when attempts are made to treat it as a physical as opposed to a purely mathematical "tool". Some of these issues are discussed in a review by Laloë [1]. Moreover, Dirac's original attempt to solve the bound electron physically with stability with respect to radiation according to Maxwell's equations with the further constraints that it was relativistically invariant and gives rise to electron spin is achievable using a classical approach. Starting with the same essential physics as Bohr, Schrödinger, and Dirac of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, advancements in the understanding of the stability of the bound electron to radiation is applied to solve for the exact nature of the electron. Rather than using the postulated Schrödinger boundary condition: "$\Psi \rightarrow 0$ as $r \rightarrow \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$-state electron cannot radiate energy*. Although it is well known that an accelerated *point* particle radiates, an *extended distribution* modeled as a superposition of accelerating charges does not have to radiate. A simple invariant physical model arises naturally wherein the predicted results are extremely straightforward and internally consistent requiring minimal math as in the case of the most famous equations of Newton, Maxwell, Einstein, de Broglie, and Planck on which the model is based. No new physics is needed; only the known physical laws based on direct observation are used. Rather than invoking untestable "flights of fantasy", the results of QED such as the anomalous magnetic moment of the electron, the Lamb Shift, the fine structure and hyperfine structure of the hydrogen atom, and the hyperfine structure intervals of positronium and muonium can be solved exactly from Maxwell's equations to the limit possible based on experimental measurements which confirms QED's illegitimacy as representative of reality.

Further examples of CQM results from closed-form equations containing fundamental constants only that can not be reproduced by SQM are given in attached

Tables summarizing the results of the calculated and experimental parameters of H_2, D_2, H_2^+ and D_2^+, one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, and twenty-electron atoms,

*the excited states of helium, the electron g factor, and relations
between fundamental particles. The closed-form derivations from
Maxwell's equations given in*

The Grand Unified Theory of Classical Quantum Mechanics posted at
http://www.blacklightpower.com/bookdownload.shtml

*contain fundamental constants only. The nature of the chemical
bond is given in Chp. 12. The atoms are solved exactly in Chps. 1, 7,
and 10. The excited states of helium are solved exactly in Chp. 9.
The electron g factor and relations between fundamental particles
are given in Chp. 1 and Chps. 27 and 30, respectively.*

Section 70

Examiner Souw's analysis is further flawed, as demonstrated by the following

statements appearing on Appendix page 20:

> Similarly, Applicant's arguments regarding the instability of excited states
> based on Quantum Electrodynamics (QED) and Dirac's theory must be
> disqualified, since Applicant has evidently misunderstood the most basic
> element of the Dirac theory, specifically regarding the physical concept
> and the mathematics of Dirac's 4-vector, as described in more details in
> section 6, subparagraph (c). Therefore, Applicant's argument on this
> subject matter remains unpersuasive.

The Examiner's statement "regarding the physical concept" is odd. If the

Examiner insists that physics must apply to the hydrogen atom, then Dirac's equation is

not a valid description as discussed in the following papers:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is
     Fiction", Physics Essays, submitted.
106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic
     Helium Which Predicts Conjugate Parameters from a Unique Solution for
     the First Time", Annales de la Fondation Louis de Broglie, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-
     Through Twenty-Electron Atoms", Physics Essays, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an
    Alternative Maxwellian Approach", Physics Essays, in press.
80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the
    Hydrogen Atom According to Quantum Mechanics, Annales de la
    Fondation Louis de Broglie, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

Specifically, the incorrectness of Dirac's equation is revealed in Applicant's paper:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics essays, submitted.

The claim that quantum electrodynamics (QED) is the most successful theory in history is critically evaluated. The Dirac equation was postulated in 1926 as a means to remedy the nonrelativistic nature of the Schrödinger equation to provide the missed fourth quantum number. The positive as well as negative square root terms provided an argument for the existence of negative energy states of the vacuum, virtual particles, and corresponding so-called quantum electrodynamics (QED) computer algorithms for calculating unexpected observables such as the Lamb shift and the anomalous magnetic moment of the electron. It is true that is possible to calculate to a high degree of precision the very small correction to the classical magnetic moment of a point-particle electron using QED, but it is at the expense of any reasonable or verifiable physics. The method relies on a string of far-fetched and unverifiable or disproved assumptions such as (1) infinite electric and magnetic fields that are arbitrarily normalized, (2) a "zoo" of infinite numbers of virtual particles at every point in space, (3) polarization of the vacuum by the proposed virtual particles, (4) postulated participation of the members of the zoo in myriad schemes to cause the so-called polarization, (5) the contribution from each such scheme corresponds to a coefficient based on the product of ratio of the mass of the virtual particle to that of the real particle being experimentally observed and α / π, and (6) the schemes can be arbitrarily truncated to avoid further infinities. Due to the lack of rigor and a physical basis, QED calculations are argued to be meaningless. In a broader sense, the connection between the underlying quantum mechanics and reality is more than just a "philosophical" issue. It reveals that quantum mechanics is not a correct or complete theory of the physical world and that inescapable internal inconsistencies and incongruities arise when attempts are made to treat it as a physical as opposed to a purely mathematical "tool". Some of these issues are discussed in a review by Laloë [1]. Moreover,

Dirac's original attempt to solve the bound electron physically with stability with respect to radiation according to Maxwell's equations with the further constraints that it was relativistically invariant and gives rise to electron spin is achievable using a classical approach. Starting with the same essential physics as Bohr, Schrödinger, and Dirac of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, advancements in the understanding of the stability of the bound electron to radiation is applied to solve for the exact nature of the electron. Rather than using the postulated Schrödinger boundary condition: "$\Psi \to 0$ as $r \to \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$-state electron cannot radiate energy.* Although it is well known that an accelerated *point* particle radiates, an *extended distribution* modeled as a superposition of accelerating charges does not have to radiate. A simple invariant physical model arises naturally wherein the predicted results are extremely straightforward and internally consistent requiring minimal math as in the case of the most famous equations of Newton, Maxwell, Einstein, de Broglie, and Planck on which the model is based. No new physics is needed; only the known physical laws based on direct observation are used. Rather than invoking untestable "flights of fantasy", the results of QED such as the anomalous magnetic moment of the electron, the Lamb Shift, the fine structure and hyperfine structure of the hydrogen atom, and the hyperfine structure intervals of positronium and muonium can be solved exactly from Maxwell's equations to the limit possible based on experimental measurements which confirms QED's illegitimacy as representative of reality.

II. Quantum Electrodynamics (QED)

Quantum mechanics failed to predict the results of the Stern-Gerlach experiment which indicated the need for an additional quantum number. In quantum mechanics, the spin angular momentum of the electron is called the "intrinsic angular momentum" since no physical interpretation exists. (Currents corresponding to the observed magnetic field of the electron can not exist in one dimension of four dimensional spacetime where Ampere's law and the intrinsic special relativity determine the corresponding unique current.) The Schrödinger equation is not Lorentzian invariant in violation of special relativity. The Schrödinger equation also misses the Lamb shift, the fine structure, and the hyperfine structure completely, and it is not stable to radiation. Quantum electrodynamics was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. But, it does not bridge the gap between quantum mechanics and special relativity. From Weisskopf [19], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; (1) does not explain nonradiation of bound electrons; (2) contains an internal

inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite; (3) it admits solutions of negative rest mass and negative kinetic energy; (4) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; (5) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. Dirac's postulated relativistic wave equation gives the inescapable result of a cosmological constant that is at least 120 orders of magnitude larger than the best observational limit due to the unacceptable states of negative mass for the description of the vacuum as discussed previously [2-7, 9-10][25]. The negative mass states further create an absolute "ether"-like frame in violation of special relativity which was disproved by the Michelson-Morley experiment.

In retrospect, Dirac's equation which was postulated to explain spin relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors; thus, it can not be the correct description of a bound electron even though it gives an addition quantum number interpreted as corresponding to the phenomenon of electron spin. Ironically, it is not even internally consistent with respect to its intent of being in accord with special relativity. In addition to violating Maxwell's equation with respect to stability to radiation wherein Maxwell's equations are implicit and the internal inconsistency with special relativity regarding the classical electron radius and states of negative rest mass and negative kinetic energy as given by Weisskopf [19], the Dirac equation violates Einstein causality and locality and conservation of energy as shown by the Klein Paradox discussed previously [2, 4, 7][26]. Furthermore, everyday observation demonstrates that causality and locality always hold. Einstein also argued that a probabilistic versus deterministic nature of atomic particles leads to disagreement with special

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[25] The Rutherford experiment demonstrated that even atoms are comprised of essentially empty space [20]. Zero-point field fluctuations, virtual particles, and states of negative energy and mass invoked to describe the vacuum are nonsensical and have no basis in reality since they have never been observed experimentally and would correspond to an essentially infinite cosmological constant throughout the entire universe including regions of no mass. As given by Waldrop [21], "What makes this problem into something more than metaphysics is that the cosmological constant is observationally zero to a very high degree of accuracy. And yet, ordinary quantum field theory predicts that it ought to be enormous, about 120 orders of magnitude larger than the best observational limit. Moreover, this prediction is almost inescapable because it is a straightforward application of the uncertainty principle, which in this case states that every quantum field contains a certain, irreducible amount of energy even in empty space. Electrons, photons, quarks—the quantum field of every particle contributes. And that energy is exactly equivalent to the kind of pressure described by the cosmological constant. The cosmological constant has accordingly been an embarrassment and a frustration to every physicist who has ever grappled with it."

[26] Oskar Klein pointed out a glaring paradox implied by the Dirac equation which was never resolved [23]. "Electrons may penetrate an electrostatic barrier even when their kinetic energy, $E - mc^2$ is lower than the barrier. Since in Klein's example the barrier was infinitely broad this could not be associated with wave mechanical tunnel effect. It is truly a paradox: Electrons too slow to surpass the potential, may still only be partially reflected. ...Even for an infinitely high barrier, i.e. $r_2 = 1$ and energies $\approx 1\,MeV$, (the reflection coefficient) R is less than 75%! From (2) and (3) it appears that as soon as the barrier is sufficiently high: $V > 2mc^2$, electrons may transgress the repulsive wall—seemingly defying conservation of energy. ...Nor is it possible by way of the positive energy spectrum of the free electron to achieve complete Einstein causality."

relativity. In fact, the nonlocality result of the Copenhagen interpretation violates causality as shown by Einstein, Podolsky, and Rosen (EPR) in a classic paper [22] that presented a paradox involving instantaneous (faster-than-light) communication between particles called "spooky action at a distance" which led them to conclude that quantum mechanics is not a complete or correct theory. The implications of the EPR paper and the exact Maxwellian predictions of "spooky action" and "entanglement" experiments, incorrectly interpreted in the context of quantum mechanic, are given in Chp. 37 of Ref. [7].

In 1947, contrary to Dirac's predictions, Lamb discovered a 1000 MHz shift between the $^2S_{1/2}$ state and the $^2P_{1/2}$ state of the hydrogen atom [24]. This so called Lamb Shift marked the beginning of modern quantum electrodynamics. In the words of Dirac [25], "No progress was made for 20 years. Then a development came initiated by Lamb's discovery and explanation of the Lamb Shift, which fundamentally changed the character of theoretical physics. It involved setting up rules for discarding ...infinities..." Renormalization is presently believed to be required of any fundamental theory of physics [26]. However, dissatisfaction with renormalization has been expressed at various times by many physicists including Dirac [27] who felt that, "This is just not sensible mathematics. Sensible mathematics involves neglecting a quantity when it turns out to be small—not neglecting it just because it is infinitely great and you do not want it!"

Albeit, the Dirac equation did not predict the Lamb shift or the electron g factor [24, 28-29], its feature of negative-mass states of the vacuum gave rise to the postulates of QED that has become a center piece of quantum mechanics to explain these and other similar observations. One of QED's seminal aspects of renormalization which was subsequently grafted into atomic theory was a turning point in physics similar to the decision to treat the electron as a point-particle-probability wave, a point with no volume with a vague probability wave requiring that the electron have an infinite number of positions and energies including negative and infinite energies simultaneously. The adoption of the probabilistic versus deterministic nature of atomic particles violates all physical laws including special relativity with violation of causality as pointed out by Einstein [22] and de Broglie [30]. Consequently, it was rejected even by Schrödinger [31].

Pure mathematics took the place of physics when calculating subtle shifts of the hydrogen atomic energy levels. Moreover, in QED, the pure mathematics approach has been confused with physics to the point that virtual particles are really considered as causing the observable. The justification for the linkage is often incorrectly associated with the usage of series expansion and variational methods to solve problems based on physical laws. But, series expansion of an equation based on a physical action or variation of a physical parameter of the equation versus the fabrication of an action based on fantastical untestable constructs that are represented by a series are clearly different. For example, the motion of a pendulum can be solved exactly in terms of an elliptic integral using Newtonian mechanics. Expansion of the elliptic integral in a power series

and ignoring negligible terms in the series versus setting up of arbitrary rules for *discarding infinities* are clearly not the same. Furthermore, inventing virtual particles that have an action on space, and subsequently on an electron, versus expanding terms in the energy equation due to a gravitating body causing a gravitational field and thus an action on the pendulum are very different. In QED, virtual particles are not merely a sustitutional or expansion variable. They are really considered as causing the observable.

In a further exercise of poor science, virtual-particle-based calculations are even included in the determination of the fundamental constants which are circularly used to calculate the parameter ascribed to the virtual particles. For example, using the electron magnetic moment anomaly in the selection of the best value of the fine structure constant, the CODATA publication [32] reports the use of virtual particles:

> "The term A1 is mass independent and the other terms are functions of the indicted mass ratios. For these terms the lepton in the numerator of the mass ratio is the particle under consideration, while the lepton in the denominator of the ratio is the virtual particle that is the source of vacuum polarization that gives rise to the term."

There is no direct evidence that virtual particles exist or that they polarize the vacuum. Even their postulation is an oxymoron.

Throughout the history of quantum theory, wherever there was an advance to a new application, it was necessary to repeat a trial-and -error experimentation to find which method of calculation gave the right answers. Often the textbooks present only the successful procedure as if it followed from first principles and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle (e.g. phenomenological Hamiltonians) to fit the empirically successful algorithm. For example, we know that it required a great deal of art and tact over decades of effort to get correct predictions out of QED. The QED method of the determination of $(g-2)/2$ from the *postulated* Dirac equation is based on a *postulated* power series of α/π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term which is processed over decades using ad hoc rules to remove infinities from each term that arises from *postulated* scores of *postulated* Feynman diagrams. The solution so obtained using the perturbation series further requires a *postulated* truncation since the series *diverges*. Mohr and Taylor reference some of the Herculean efforts to arrive at g using QED [32]:

> "the sixth-order coefficient $A_1^{(6)}$ arises from 72 diagrams and is also known analytically after nearly 30 years of effort by many researchers [see Roskies, Remiddi, and Levine (1990) for a review of the early work]. It was not until 1996 that the last remaining distinct diagrams were calculated analytically, thereby completing the theoretical expression for $A_1^{(6)}$".

For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off the infinities) in one particular way and not in some other way that appears in principle equally valid. For example, Milonni [33] presents a QED derivation of the magnetic moment of the electron which gives a result of the wrong sign and requires the introduction of an

"upper limit K in the integration over $k = \omega/c$ in order to avoid a divergence."

A differential mass is arbitrarily added, then

"the choice $K = 0.42mc/\hbar$ yields $(g-2)/2 = \alpha/2\pi$ which is the relativistic QED result to first order in α. [...] However, the reader is warned not to take these calculations too seriously, for the result $(g-2)/2 = \alpha/2\pi$ could be obtained by retaining only the first (radiation reaction) term in (3.112) and choosing $K = 3mc/8\hbar$. It should also be noted that the solution $K \cong 0.42mc/\hbar$ of (3.112) with $(g-2)/2 = \alpha/2\pi$ is not unique."

Such an ad hoc nonphysical approach makes incredulous:

" the cliché that QED is the best theory we have!" [34]

or the statement that:

"The history of quantum electrodynamics (QED) has been one of unblemished triumph" [35].

There is a corollary, noted by Kallen: from an inconsistent theory, any result may be derived.

In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, a classical approach was explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level [2-7]. Physical laws and intuition are restored when dealing with the wave equation and quantum mechanical problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles that successfully applies physical laws on all scales. Rather than use the postulated Schrödinger boundary condition: "$\Psi \to 0$ as $r \to \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$-state electron cannot radiate energy.* The electron must be extended rather than a point. On this basis with the assumption that physical laws including Maxwell's equation apply to bound electrons, the hydrogen atom was solved exactly from first principles. The remarkable agreement across the spectrum of experimental results indicates that this is the correct model of the hydrogen atom.

It was shown previously that quantum mechanics does not explain the stability of the atom to radiation [2]; whereas, the Maxwellian approach gives a natural relationship between Maxwell's equations, special relativity, and general relativity. CQM holds over a scale of spacetime of 85 orders of magnitude—it correctly predicts the nature of the universe from the scale of the quarks to that of the cosmos [3]. A review is given by Landvogt [36]. In a

third paper, the atomic physical approach was applied to multielectron atoms that were solved exactly disproving the deep-seated view that such exact solutions can not exist according to quantum mechanics. The general solutions for one through twenty-electron atoms are given in Ref [4]. The predictions are in remarkable agreement with the experimental values known for 400 atoms and ions. A fourth paper presents a solution based on physical laws and fully compliant with Maxwell's equations that solves the 26 parameters of molecular ions and molecules of hydrogen isotopes in closed-form equations with fundamental constants only that match the experimental values [5]. In a fifth paper, the nature of atomic physics being correctly represented by quantum mechanics versus classical quantum mechanics is subjected to a test of internal consistency for the ability to calculate the conjugate observables using the same solution for each of the separate experimental measurements [6]. It is confirmed that the CQM solution is the accurate model of the helium atom by the agreement of predicted and observed conjugate parameters of the free electron, ionization energy of helium and all two electron atoms, ionization energies of multielectron atoms, electron scattering of helium for all angles, and all He I excited states using the same unique physical model in all cases. Over five hundred conjugate parameters are calculated using a unique solution of the two-electron atom without any adjustable parameters to achieve overall agreement to the level obtainable considering the error in the measurements and the fundamental constants in the closed-form equations.

In contrast, the quantum fails utterly. Ad hoc computer algorithms are used to generate meaningless numbers with internally inconsistent and nonphysical models that have no relationship to physics. Attempts are often made to numerically reproduce prior theoretical numbers using adjustable parameters including arbitrary wave functions in computer programs with precision that is often much greater (e.g. 8 significant figures greater) than possible based on the propagation of errors in the measured fundamental constants implicit in the physical problem.

In this sixth paper of a series, rather than invoking renormalization, untestable virtual particles, and polarization of the vacuum by the virtual particles, the results of QED such as the anomalous magnetic moment of the electron, the Lamb Shift, the fine structure and hyperfine structure of the hydrogen atom, and the hyperfine structure intervals of positronium and muonium (thought to be only solvable using QED) are solved exactly from Maxwell's equations to the limit possible based on experimental measurements.

Section 71

Other aspects of Examiner Souw's analysis also prove to be nonsensical, such as the following discussion on Appendix page 20:

4.   **Regarding "Applicant misunderstands the most basic fundamentals of the QM theory"**

(a)   Applicant's attempt to argue that Applicant's electron wave function p(r,t) involving ä-function <u>does not need to satisfy --or must not be a solution of-- the wave equation</u> (pg.45) is totally unacceptable, and hence, unpersuasive because applicant's response contradicts the mathematical requirement that any valid solution <u>must</u> satisfy the generic equation.

The Examiner's comment about Applicant's argument being "unpersuasive because applicant's response contradicts the mathematical requirement that any valid solution <u>must</u> satisfy the generic equation" is not well taken. On which physical law is this statement by the Examiner based? In fact, radial motion in an inverse-squared field according to SQM violates stability and conservation of energy, as pointed out in Section 63 above.

Section 72

On Appendix page 20, Examiner Souw further argues, inconsistently, that:

> Applicant's insistence that his ä-function-based "solution" p(r,t) <u>does not need to satisfy --or must not be a solution of-- the wave equation</u>, violates the basic laws of physics and mathematics. It must be emphasized that the entire physics and mathematics that have been developed since Newton and Leibniz form together a non-self-contradictory entity generally accepted by the scientific community. It is a <u>high barrier to disprove what is accepted by conventional science</u>, such as QM (Quantum Mechanics).

Regarding the false assertion that Applicant's position "violates the basic laws of physics and mathematics," the Examiner offers no law of nature that requires this to be true. In fact, it is not even internally consistent with SQM' s rigid-rotor equation [McQuarrie, D. A., *Quantum Chemistry*, University Science Books, Mill Valley, CA, (1983), pp. 206-225]. See Section 63 above.

Section 73

Examiner Souw is also flat out wrong in his statement on page 21 of the Appendix that:

Since Applicant's GUT is entirely based on this ä-function-based electron wave function p(r,t) which is not a solution of his own starting wave equation, Applicant's flawed GUT does not provide any theoretical support to this patent application. Any further attempt to argue the patentability of his application by relying on GUT will be dismissed as UNPERSUASIVE with referral to this section, *II.4.a.*.

This is not true at all. As shown in Section 63 above and GUT Chp. 1 [Ref. #1], the condition of nonradiation requires that the three-dimensional wave equation plus time be reduced to the two-dimensional wave equation plus time. This equation IS rigorously solved for 100's of observables with remarkable agreement between predicted and experimental values. The results are absolutely predictive in that the same solution for the electron is used in all of the 100's of predictions. There is not a single example in SQM where this is the case. Others agree with Applicant as indicated in Section 54 above. The Examiner's refusal to acknowledge these facts is telling.

Section 74

Examiner Souw continues his flawed analysis by stating on Appendix page 21:

(b) Applicant's angular momentum wave functions (instead of eigenfunctions), as derived in GUT and partly reproduced on pg.58-64, are mathematically flawed and in direct violation of the conventional QM, as already described in the previous Appendix. It turns out, Applicant's rejection of QM is solely caused by Applicant's misunderstanding and misinterpretation of the QM, the latter having been acknowledged in the art as being the most successful theory in the whole history of physics. The validity of QM has been quantitatively verified by multiple generations of physicists/scientists and by thousands, if not millions of phenomena and effects encountered in science and technology.

The angular functions are charge-density waves that describe real charge moving in space and time. They do not refer to the weird probability-density functions of quantum mechanics that are nonphysical. The CMQ results match the data exactly. In contrast, the SQM result has many problems in this regard regarding infinities and nondegeneracy in the absence of a magnetic field as reported in the literature previously:

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

The hype associated with standard quantum mechanics is incredible, especially given that it has never solved a single problem using physical laws with internal consistency and comprises nonphysical computer curve-fitting algorithms. It is not predictive since there is not a single example where a SQM result can be used to predict another, even known result. Some of the hype is discussed in Section 70 above.

The made-up procedures and ad hoc curve fitting approaches discussed in Section 70, Appendix II of Mills GUT (Ref. #1), and paper #107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted, make these types of statements incredulous. SQM can not match the closed-form results given in the QED paper (#107) and Mills GUT, some of which are summarized in Sections 55 and 69 above.

Section 75

Examiner Souw repeats prior erroneous statements on page 21 of the Appendix, wherein he claims:

> In contrast, applicant's flawed "theory" has not been verified even by a single experiment conducted by an independent third party to date. Thus, Applicant's argument regarding alleged flaws in QM is unpersuasive.

CQM unifies Maxwell's equations, special, and general relativity with atomic physics. It predicts gravitation from fundamental particles and predicts their masses. It

gives closed-form equations with fundamental constants only for the masses and the evolution of the cosmos as a function of time. Applicant's theory correctly predicted by mass of the top quark before it was detected on the D0 detector. It also correctly predicted the acceleration of the expansion of the universe before it was detected to the shock of cosmology experts.

CQM also predicted the existence of hydrinos before experiments were run. In addition to the results given in Applicant's 112 experiments, independent researchers have also conformed this prediction of CQM, as summarized in the 51 reports and papers given in the section entitled "Independent Test Results". Since SQM is not predictive, it is not surprising that it did not and can not predict any of these discoveries. For example, the ratios of the masses of fundamental particles that can not be reproduced by SQM are:

RELATIONS BETWEEN FUNDAMENTAL PARTICLES

The relations between the lepton masses and neutron to electron mass ratio which are independent of the definition of the imaginary time ruler ti including the contribution of the fields due to charge production are given in terms of the dimensionless fine structure constant α only:

$$\frac{m_\mu}{m_e} = \left(\frac{\alpha^{-2}}{2\pi}\right)^{\frac{2}{3}} \frac{\left(1 + 2\pi\frac{\alpha^2}{2}\right)}{\left(1 + \frac{\alpha}{2}\right)} = 206.76828 \qquad (206.76827)^a$$

$$\frac{m_\tau}{m_\mu} = \left(\frac{\alpha^{-1}}{2}\right)^{\frac{2}{3}} \frac{\left(1 + \frac{\alpha}{2}\right)}{\left(1 - 4\pi\alpha^2\right)} = 16.817 \qquad (16.817)$$

$$\frac{m_\tau}{m_e} = \left(\frac{\alpha^{-3}}{4\pi}\right)^{\frac{2}{3}} \frac{\left(1 + 2\pi\frac{\alpha^2}{2}\right)}{\left(1 - 4\pi\alpha^2\right)} = 3477.2 \qquad (3477.3)$$

$$\frac{m_N}{m_e} = \frac{12\pi^2}{1-\alpha} \sqrt{\frac{\sqrt{3}}{\alpha}} \frac{\left(1 + 2\pi\frac{\alpha^2}{2}\right)}{\left(1 - 2\pi\frac{\alpha^2}{2}\right)} = 1838.67 \qquad (1838.68)$$

a Experimental according to the 1998 CODATA and the Particle Data Group [K. Hagiwara et al., Phys. Rev. D 66, 010001 (2002); http://pdg.lbl.gov/2002/s035.pdf; P. J. Mohr and B. N. Taylor, "CODATA recommended values of the fundamental physical constants: 1998", Reviews of Modern Physics, Vol. 72, No. 2, April, (2000), pp. 351-495].

The agreement between the experimental and observed values is truly remarkable, as is the Examiner's failure to recognize this astonishing accomplishment.

Section 76

Examiner Souw further argues on page 21 of the Appendix that:

(c) Applicant's remark, *"there is no a priori basis for any theory to be correct"*, does not contradict the Examiner's view. However, there are plenty of a priori basis for a theory to be incorrect, e.g., if the theory is incredible, illogical and/or self-contradictory, such as Applicant's GUT and hydrino theory.

Since SQM predicts infinities in the electron's electric and magnetic fields and they are not observed, it is proven wrong. Since SQM predicts that the electron in the n=1 state has instantaneous acceleration, it must radiate. Since radiation is not observed, again, it is proven wrong. Since the angular solutions that are square-integrable predict large nondegeneracy in the orbital angular momenta and energies and these are not observed, it is further proven wrong. Since SQM predicts the electron can move radially from the nucleus (and even be inside the nucleus) violating conservation of energy and angular momentum and such violation is not observed, SQM is proven wrong yet again. The list goes on and on.

See:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.
106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

In contrast Applicant's CQM is based on Maxwell's equation and special and general relativity. These physical laws have never been proven wrong, and now Applicant has shown how to solve them on the level of the atom with stunningly accurate results.

Section 77

Examiner Souw argues on pages 21-22 of his Appendix that:

The Examiner's view on Applicant's theory and experimental evidence is totally different than Applicant's: (a) A correct scientific theory must be mathematically and conceptually self-consistent, and should not contain self-contradiction, e.g., mathematical flaws. In this regard, Applicant's entire theory, as documented in the GUT document, contains an unprecedented amount of mathematical flaws and errors, as already demonstrated in the previous Appendixes included in all the office actions of record, some of which are now repeated, confirmed and emphasized.

The Examiner has it backwards. These deficiencies rest with SQM, not CQM, as discussed in the prior theory sections of this Response.

Section 78

The Examiner asserts on page 22 of his Appendix that:

(b) A correct scientific concept must be proven by experimental evidence. In this regard, NONE of Applicant's "experimental evidence" is scientifically valid, as already discussed by the Primary Examiner(s) in his/her main Office Action. Applicant's alleged "evidence" falls into three categories, which have been discussed in Part I and already presented in the previous Appendix.

This redundant issue has already been dismissed in the Experimental sections of this Response.

Section 79

Examiner Souw also wrongly argues on Appendix page 22 that:

5. Regarding Applicant's misunderstanding of Haus's non-radiative condition

(a) On pg. 51/lines 4-5, Applicant recites: *"a time dependent charge corresponds to a current"*. This is <u>just one</u> of the unprecedented number of mathematical flaws and misunderstanding of elementary physical concepts in Applicant's GUT. The mathematical flaw lies in the fact that a current J is a vector quantity (or field), whereas p(r,t) is a scalar, so they can never be the same as claimed by Applicant (J??/ñ?t, since the left hand side is a vector and the right hand side is a scalar). The physical flaw lies in the fact that they are fundamentally of different natures. <u>Only together</u> (hence their different natures!) they form the charge conservation law, i.e., by virtue of the well known formula *div·J*+?ñ/?t =0 (note the scalar operation *div·* on vector *J*; not *J* itself). The GUT is completely silence on such mathematical relation and/or operation. Hence, any <u>hindsight</u> argument in this direction from Applicant's side inevitably would be automatically considered invalid and unpersuasive.

Regarding the Examiner's argument based on "the fact that a current J is a vector quantity (or field), whereas p(r,t) is a scalar," Applicant points out that he correctly considered the vector aspect of the current. In the paper 58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press, appears:

The current due to the time dependent term is

$$\mathbf{J} = \frac{\omega_n}{2\pi} \frac{e}{4\pi r_n^2} N[\delta(r - r_n)] \operatorname{Re}\left\{ Y_\ell^m(\theta,\phi) \right\}[\mathbf{u}(t) \times \mathbf{r}]$$

$$= \frac{\omega_n}{2\pi} \frac{e}{4\pi r_n^2} N[\delta(r - r_n)] \operatorname{Re}\left\{ Y_\ell^m(\theta,\phi) e^{i\omega_n t} \right\}[\mathbf{u} \times \mathbf{r}]$$

$$= \frac{\omega_n}{2\pi} \frac{e}{4\pi r_n^2} N'[\delta(r - r_n)] \operatorname{Re}\left(P_\ell^m(\cos\theta) e^{im\phi} e^{i\omega_n t} \right)[\mathbf{u} \times \mathbf{r}]$$

$$= \frac{\omega_n}{2\pi} \frac{e}{4\pi r_n^2} N'[\delta(r - r_n)]\left(P_\ell^m(\cos\theta)\cos(m\phi + \omega_n' t) \right)[\mathbf{u} \times \mathbf{r}] \tag{21}$$

$$= \frac{\omega_n}{2\pi} \frac{e}{4\pi r_n^2} N'[\delta(r - r_n)]\left(P_\ell^m(\cos\theta)\cos(m\phi + \omega_n' t) \right)\sin\theta\,\hat{\phi}$$

where to keep the form of the spherical harmonic as a traveling wave about the z-axis, $\omega_n' = m\omega_n$ and N and N' are normalization constants. The vectors are defined as

$$\hat{\phi} = \frac{\hat{u} \times \hat{r}}{|\hat{u} \times \hat{r}|} = \frac{\hat{u} \times \hat{r}}{\sin\theta}; \qquad \hat{u} = \hat{z} = orbital\ axis \tag{22}$$

$$\hat{\theta} = \hat{\phi} \times \hat{r} \tag{23}$$

"^" denotes the unit vectors $\hat{u} \equiv \dfrac{\mathbf{u}}{|\mathbf{u}|}$, non-unit vectors are designed in bold, and the

current function is normalized.

Section 80

Examiner Souw further argues on page 23 of his Appendix that:

(b) In GUT, as well as on pg. 51/ff of 83, Applicant's Eqs. 1-39 through
1.45 are mathematically flawed, as already recited in the previous
Appendix, sect.4/pg.3/lines 8-12 and pg.4/lines 9. One of ordinary skill in
the art can easily show that Applicant's charge density p(r,t) is <u>neither</u> a
solution of the Maxwell/Helmholtz equation in terms of Laplace operator
<u>nor</u> the Schrödinger equation, i.e., by virtue of the fully analytical integral
representation of the ä-function that can be mathematically treated in a
rigorous manner (see original Appendix, section 4). Not only is this
<u>another</u> example out of an unprecedented number of mathematical flaws
and misunderstanding of elementary physical concepts in Applicant's
GUT, but most importantly, a solid proof that Applicant's derivation of the
hydrino theory is based on the failure to apply rigorous mathematics as
proofs as every physics theory should be based upon

Applicant's charge density functions are solutions of the two-dimensional wave
equation plus time, as discussed above in Sections 63 and 73 above. These solutions
are well known as given in Chp I of Mills GUT and McQuarrie, D. A., *Quantum*

Chemistry, University Science Books, Mill Valley, CA, (1983), pp. 206-225. They satisfy the constraint of nonradiation according to Maxwell's equation as shown in the following peer-reviewed paper:

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

and in Chp 1 and Appendix I of Mills GUT. They are unprecedented in their success at predicting experimental observables as discussed in previous sections, including Sections 54-55 and 69-70.

Section 81

Examiner Souw further argues on page 23 of the Appendix that:

(c) Applicant's Eq. 1.41 to 1.45 are based on an incorrect application -- and is a result of his serious misunderstanding-- of the Special Relativity Theory, specifically regarding the inapplicability of the theory to a circulating electron, as already described in previous Appendix. Applicant has failed to address the Examiner's refutation and show a proper understanding of the Relativity Theory in his response to the Examiner's Appendix (see also last section 10).

Applicant's theory is the most successful to date at applying special relativity to the atom, as shown in Section 55 of this Response. SQM can not match these results and is incompatible with special relativity as shown in:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.
80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

SQM lacks Einstein causality and even resurrects the disproved ether. Since the electron motion can not be defined, it is impossible to apply special relativity to SQM, which indicates a huge failure. However, another problem arises by correcting the mass while maintaining the invariance of charge under special relativity. The mass to charge ratio is then not invariant; thus, the Bohr magneton of magnetic moment is not invariant. Since experimentally it is invariant, SQM is disproved in yet another instance.

Furthermore, in additional refutation of past rejections by the Examiner:

The electron moves in an orbit relative to the laboratory frame. Muons and electrons are both leptons. Time dilation of muonic decay due to relativistic motion in a cyclotron orbit relative to a stationary laboratory frame provides strong confirmation of special relativity and confirms that the electron's frame is an inertial frame. eB/m bunching of electrons in a gyrotron [P. Sprangle and A. T. Drobot, "The linear and self-consistent nonlinear theory of the electron cyclotron maser instability", IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-25, No. 6, June, (1977), pp. 528-544] occurs because the cyclotron frequency is inversely proportional to the relativistic electron mass. This further demonstrates that the electron frame is an inertial frame and that electron mass and time dilation occur. The special relativistic relationship in polar coordinates is derived. The result of the treatment of the electron motion relative to the laboratory frame is in excellent agreement with numerous experimental observables such as the electron g factor, the invariance of the electron magnetic moment of μ_B and angular momentum of $\hbar$, the fine structure of the hydrogen atom, and the relativistically corrected ionization energies of one and two electron atoms given in:

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

and in the Excited States of the One-Electron Atom (Quantization) and The Two-Electron Atom sections of Mills GUT.

Section 82

On pages 23-24 of the Souw Appendix, the Examiner further argues:

(d) Applicant's statement on pg.55 that, "[t]he distinction between an eigenfunction and a wavefunction comprised of eigenfunctions is due entirely to a mathematical postulate of QM", is mathematically incorrect:

Per definition, eigenfunctions are solutions of an eigenvalue equation. Not only the Schrödinger Equation (SE), but also the electromagnetic wave equation of Helmholtz are eigenvalue equations. Consequently, the monochromatic wave function exp i(kx-ùt) is an eigenfunction solution of the wave equation, and a wave packet can be constructed as a superposition of such eigenfunctions. Applicant's GUT theory is based on applicant's serious misunderstanding in this crucial subject matter.

What is there to be confused about? Applicant understands that the basic function sinwt is an eigenfunction; others may be more complicated, but the distinguishing feature is that the derivative is a constant times the function.

Applicant made the point in a prior Action that a sum of eigenfunctions is an eigenfunction. It is irrelevant that SQM requires that the eigenfunctions be square integrable, which is the original argument that the Examiner is diverting from. He admits that linear combinations of eigenfunctions do not work in SQM since SQM is not a theory based on physics. It is nonsensical to square a probability-wave function to get a charge or mass function. In CQM the electron states comprise the sum of a constant charge-density function corresponding to spin angular momentum and a spherically- and time-harmonic function that modulates the constant function and corresponds to orbital angular momentum. This eliminates the failures of SQM in providing a current corresponding to spin, the lack of degenerate orbital angular levels in the absence of a magnetic field, and other failings as reported previously in the literature:

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

Section 83

Examiner Souw continues his flawed analysis by arguing on page 24 of his Appendix that:

6. Applicant's confusion regarding wavefunction and eigenfunction

(a) Due to applicant's misunderstanding of eigenfunctions (see above), applicant then proceeds to separate the physics of angular momentum from its mathematics (e.g., on pg.54-55, and once again on pg.64). A most important characteristic of modern science (ever since Newton) is, that physics must be quantitatively expressed in rigorous mathematics (besides it must be also experimentally verifiable, independent of time, location and observer). The mathematical basis for the QM concept, including the complementary property of position and momentum as well as the Heisenberg uncertainty principle (HUP), is the Fourier Transform, in which both the HLJP as well as the concept of eigenfunctions, as distinguished from a superposition (wavepacket), can be intuitively grasped by one of ordinary skill in the art.

Actually it is SQM that is not correct according to physical laws, and CQM does not suffer from these flaws as discussed in Sections 73, 80, and 82 above. The Examiner is correct that Applicant does not solve for a probability-density function that is square-integrable as in the case of SQM. Applicant has shown that this is not correct in that it leads to disagreement between predictions and experiments that do not occur in the case of CQM. The fact that SQM relies on such a probability-wave construct requires that it is implicitly in violation of physical laws as shown in:

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey,

Distributed by Amazon.com; January 2005 Edition posted at
www.blacklightpower.com.

It is further trivially appreciated that mass and charge add linearly, not as the
square of the sum.

Applicant admits that he has no idea what the Examiner is saying with the
following string of seeming flights of fantasy:

> The mathematical basis for the QM concept, including the complementary
> property of position and momentum as well as the Heisenberg uncertainty
> principle (HUP), is the Fourier Transform, in which both the HUP as well
> as the concept of eigenfunctions, as distinguished from a superposition
> (wavepacket), can be intuitively grasped by one of ordinary skill in the art.

This speak is not found in any classical physics book that Applicant is aware of.
Where in the literature is the Fourier Transform taken on the HUP for example, and
what is its physical significance? In any event, Applicant's theory is intuitive and
derived from physical laws so no such esoteric utterances arise.

Section 84

Examiner Souw further argues on pages 24-25 of his Appendix that:

(b) On pg.55/lines 8-10 from bottom, Applicant's statement regarding the
impossibility of zero rotational energy in case of zero angular momentum
(L=0) has no basis whatsoever, and hence, is here dismissed and
disregarded. For L=0, the wavefunction is known to be spherical
symmetric, meaning that the electron is everywhere within 0? (è,ö)?2∂
with equal probability. To "see" an electron density probability that is
inhomogeneous over the angle coordinates (è,ö), a superposition of
angular momenta eigenfunctions is necessary, as described in the original
Appendix, which also means that äL>0 and the system is no longer
spherical-symmetric. A spherical-symmetric system (L=0) has a zero
angular momentum, since $L^2 Y_{L,m1}(è,ö) = 0$ for L=0, and $L Y_{0,0}(è,ö) = (r \times p) Y_{0,0}(è,ö)$ with p being a differential operator (defined by McQuarrie [1]
Eqs.6-81 & 6-83), is also identical to zero, since $Y_{0,0}(è,ö)$ is a constant
(see previous Appendix pg.5-6). Consequently, the rotational energy,
$E_R = L(L+1)\_^2/2I$ (McQuarrie [1] Eq.6-61/pg.219), is also zero for L=0,
whereas $E_R = \_^2/I$ for L=1, in direct contradiction to Applicant's claim that
the lowest rotational energy is $E_R = \_^2/2mr^2$, as recited on pg.55 lines 24-
25. Applicant has obviously misunderstood his own cited reference
McQuarrie [1], i.e., by inserting L=1 (but not

L=0) and I=mr^2 in Eq.6-61 on pg. 219 and 209, where r is there <u>NOT</u> the radius of hydrogen <u>atom</u> as Applicant would like to mean, but (r is) the inter-atomic distance in a <u>diatomic molecule</u>, whereas Applicant's m, or McQuarrie's i., is its reduced mass, as recited in [1] on pg.212/Example 6-5. It is also clear that <u>L=0 is inclusive</u> in the complete set, as recited in Eq.6-60 in [1] on pg.209. McQuarrie [1] discusses in §6-5 to §6-7 the Rigid Rotator model, unambiguously reciting in the title of §6-5 that the Rigid Rotator is a Model for a Rotating <u>Diatomic Molecule</u> ([1}/pgs.210-221).

The Examiner admits that in SQM, the electron has no angular momentum, which is impossible for the case of any physical object bound by an inverse-squared force law, as shown in any basic mechanics book such as

G. R. Fowles, <u>Analytical Mechanics</u>, Third Edition, Holt, Rinehart, and Winston, New York, (1977), pp. 145-158.

Thus, the **Examiner has admitted that SQM does not agree with physical laws**.

Regarding Examiner Souw's comments regarding the "contradiction to Applicant's claim that the lowest rotational energy is $E_R = \_^2/2mr^2$, as recited on pg.55 lines 24-25," Applicant notes that, in CQM, the orbital angular momentum is zero for L=0, and the spin angular momentum is not zero as it must be and is given in Chp 1 of Mills GUT:

The z-axis projection of the spin angular momentum was derived in the Spin Angular Momentum of the Orbitsphere with $\ell = 0$ section.

$$L_z = I\omega i_z = \pm\frac{\hbar}{2} \tag{1.78}$$

where ω is given by Eq. (1.55); so,

$\ell = 0$

$$|L_z| = I\frac{\hbar}{m_e r^2} = \frac{\hbar}{2} \tag{1.79}$$

Thus,

$$I_z = I_{spin} = \frac{m_e r_n^2}{2} \tag{1.80}$$

From Eq. (1.51),

$$E_{rotational\ spin} = \frac{1}{2}\left[I_{spin}\omega^2\right] \tag{1.81}$$

From Eqs. (1.55) and (1.80),

$$E_{rotational} = E_{rotational\ spin} = \frac{1}{2}\left[I_{spin}\left(\frac{\hbar}{m_e r_n^2}\right)^2 \right] = \frac{1}{2}\left[\frac{m_e r_n^2}{2}\left(\frac{\hbar}{m_e r_n^2}\right)^2 \right] = \frac{1}{4}\left[\frac{\hbar^2}{2I_{spin}} \right] \quad (1.82)$$

When $\ell \neq 0$, the spherical harmonic is not a constant and the charge-density function is not uniform over the orbitsphere. Thus, the angular momentum can be thought of arising from a spin component and an orbital component.

The Examiner's mistakenly argues McQuarrie's rigid rotor problem, which does not apply for l=0.

Section 85

Examiner Souw continues his erroneous analysis by stating on page 25 of the Appendix that:

> Hydrogen atom is handled by McQuarrie [1] in §6-8 on pg.221 ff. As stated by McQuarrie [1] on pgs.222-223, Eqs. 6-99 & 6-100, the energy of a hydrogen electron for different quantum numbers (n,L,m) in the absence of magnetic field is <u>degenerate in (L,m)</u>, as recited on pg.225, line 20-22 of § 6-9, i.e., it depends only on the principal quantum n, with L satisfying 0=L=n-1 (Eq.6-101 in [1]/pg.223), i.e., <u>L=0 also inclusive</u>. Obviously, Applicant's has misunderstood the zero angular momentum case in his own cited reference, McQuarrie [1], for misinterpreting $Y_{0,0}$ as being a spin eigenfunction (GUT, Eqs.1.61-1.65) based on his erroneous understanding that L=0, or zero rotational energy, is impossible, as recited by Applicant on (pg.55, lines 24-25).

First of all, it is impossible to have zero rotational energy for a moving bound electron. Furthermore, despite what is says in McQuarrie [1], SQM has it wrong on the issue of degeneracy of hydrogen atomic energy levels, as reported in the literature previously:

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

From Ref. #80:

1.) The HUP gives a lower limit to the product of **the *uncertainty* in the momentum and the *uncertainty* in the position—not the product of the momentum and the position**. The momentum or position could be arbitrarily larger or smaller than its uncertainty. For example, QM textbooks express the movement of the electron, and the HUP is an expression of the statistical aspects of this movement. McQuarrie [25], gives the electron speed in the $n = 1$ state of hydrogen as $2.18764 \, X \, 10^6 \, m/sec$. Remarkably, the uncertainty in the electron speed according to the HUP is $1.4 \, X \, 10^7 \, m/sec$ [26] which is an order of magnitude larger than the speed. The short comings of the theory are obvious given that the constant parameters of the hydrogen atom are known to 10 figure accuracy.

2.) Eq. (3) follows from the Schrodinger equation, not the Bohr theory. In the time independent Schrödinger equation, the kinetic energy of rotation K_{rot} is given by [20]

$$K_{rot} = \frac{\ell(\ell+1)\hbar^2}{2mr^2}$$

(11)

where

$$L = \sqrt{\ell(\ell+1)\hbar^2}$$

(12)

is the value of the electron angular momentum L for the state $Y_{lm}(\theta,\phi)$.

At page 365 Margenau and Murphy [20] state

" but with the term $\dfrac{\ell(\ell+1)\hbar^2}{2mr^2}$ added to the normal potential energy. What is the meaning of that term? In classical mechanics, the energy of a particle moving in three dimensions differs from that of a one-dimensional particle by the kinetic energy of rotation, $\dfrac{1}{2}mr^2\omega^2$.

This is precisely the quantity $\dfrac{\ell(\ell+1)\hbar^2}{2mr^2}$, for we have seen that $\ell(\ell+1)\hbar^2$ is the *certain* value of the square of the angular momentum for the state Y_ℓ, in classical language $\left(mr^2\omega^2\right)^2$ which is divided by $2mr^2$, gives exactly the kinetic energy of rotation."

For the n=1 state, $\ell = 0$; thus, **the angular momentum according to the Schrodinger equation is exactly zero—not** $\hbar$. Furthermore, the kinetic energy of rotation K_{rot} is also **zero**. As a consequence, it is internally inconsistent for Feynman to accept the HUP which arises from the Schrodinger equation on the one hand and that the electron obeys the classical Coulomb law and is bound in an inverse squared Coulomb field on the other. Rather than a kinetic energy of $\dfrac{\hbar^2}{2mr^2}$ which is added to the Coulomb energy of $-\dfrac{e^2}{r}$ to get the total energy, exactly zero should be added to the Coulomb energy. This is an inescapable nonsensical result which arises from the SE directly, and it can not be saved by incorrectly assigning the angular momentum as $\hbar$ from the uncertainty relationship. Furthermore, the result that $L = K_{rot}$ = **exactly zero violates the HUP making the argument further internally inconsistent.** In addition, applying Eq. (3) to spherical harmonic solutions for Ψ with an exact momentum and energy for a given ℓ in Eqs. (11) and (12), respectively, requires that $\Delta\theta \to \infty$ since $\Delta L = 0$ in the relationship $\Delta L \Delta\theta \geq \dfrac{\hbar}{2}$. The result $\Delta\theta \to \infty$ is nonsensical. Postulating a linear combination of spherical harmonics is not consistent with a single momentum state and will not save the HUP since the linear combination is not an eigenfunction. Rather it is a wavefunction of a set that is not orthonormal (i.e. it violates QM postulates by not yielding the Kroenecker delta).

20. H. Margenau, G. M. Murphy, *The Mathematics of Chemistry and Physics*, D. Van Nostrand Company, Inc., New York, (1956), Second Edition, pp. 363-367.

From 17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

In the time independent Schrodinger equation, the kinetic energy of rotation K_{rot} is given by

$$K_{rot} = \frac{\ell(\ell+1)\hbar^2}{2mr^2} \tag{10}$$

where

$$L = \sqrt{\ell(\ell+1)\hbar^2} \tag{11}$$

is the value of the electron angular momentum L for the state $Y_{lm}(\theta,\phi)$.

• In the time independent Schrodinger equation, the kinetic energy of rotation K_{rot} is given by Eq. (10) where the value of the electron angular momentum L for the state $Y_{lm}(\theta,\phi)$ is given by Eq. (11). The Schrodinger equation solutions, Eq. (10) and Eq. (11), predict that the ground state electron has zero angular energy and zero angular momentum, respectively.

• The Schrodinger equation solution, Eq. (11), predicts that the ionized electron may have infinite angular momentum.

• The Schrodinger equation solutions, Eq. (10) and Eq. (11), predict that the excited state rotational energy levels are nondegenerate as a function of the ℓ quantum number even in the absence of an applied magnetic field, and the predicted energy is over six orders of magnitude of the observed nondegenerate energy in the presence of a magnetic field. In the absence of a magnetic field, no preferred direction exists. In this case, the ℓ quantum number is a function of the orientation of the atom with respect to an arbitrary coordinate system. Therefore, the nondegeneracy is nonsensical and violates conservation of angular momentum of the photon.

• The Schrodinger equation predicts that each of the functions that corresponds to a highly excited state electron is not integrable and can not be normalized; thus, each is infinite.

It is trivial to appreciate that SQM fails and does not provide for the degeneracy of the angular momentum and rotational energy in the absence of a magnetic field for the trial case that n=1 with l=0 versus l=1 in Eqs. (10-11).

Section 86

Examiner Souw further errs in arguing on Appendix pages 25-26 that:

The Examiner also takes issue with applicant's removal of $Y_{0,0}$ out of the <u>complete set</u> of angular momentum eigenfunctions $Y_{L,m}(è,ö)$. As known in the art, the solutions of an eigenvalue equation form altogether a <u>complete set</u> of eigenfunctions. By taking out $Y_{0,0}$ Applicant's <u>incomplete set</u> of $Y_{L,m}(è,ö)$ (L,m>0) is now <u>incapable</u> of representing an <u>arbitrary</u> function of <u>(è,ö)</u>, since it is a mathematical rule generally known in the art that an <u>arbitrary</u> function (emphasis on the <u>arbitrary</u>) can only be represented by a <u>complete</u> set of eigenfunctions with all possible values of L, from L=0 to L=8. Thus L=0 cannot be taken out, as done by Applicant. In view of these serious misunderstandings by the applicant, applicant's arguments on angular momentum and spin are unpersuasive.

Applicant does not take Y0,0 out, as shown in Section 84 above and Chp 1 of Mills GUT, while SQM does. It has no rotational energy corresponding to spin angular momentum; yet, it has infinite energy io the electron's magnetic moment of a Bohr magneton.

Section 87

On page 26 of his Appendix, Examiner Souw further argues, erroneously, that:

> Still on pg.55, Applicant's statement *"the Examiner's requirement of taking linear combinations of eigenfunctions to result in a wavefunction solution to **avoid violating** the Uncertainty Principle* ", is another example of Applicant's misunderstanding of the Uncertainty Principle, as once again manifested on pg.65 of the amendment discussed below. Either a superposition of eigenfunctions, or a single eigenfunction, are **both** valid manifestations of the Uncertainty Principle, äp?äx?? or äL?äö??, for any two complementary observables. **None** of them violates the Uncertainty Principle, as contended by Applicant. See also the same conceptual mistake in sub-paragraph 6(d) below.

This failure of SQM is discussed in Ref. #80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted, and in Section 85 above.

Section 88

Examiner Souw's erroneous analysis is further exposed by his statements on pages 26-27 of his Appendix:

> (c) Applicant's angular momentum wave functions as postulated (but not derived) in the GUT and repeated on pg.58-64 are mathematically flawed, since they contain mathematical inconsistencies and self-contradictions, as discussed in previous Souw Appendix (sect.6/pg.5-7). Accordingly, Applicant's argument regarding this subject matter is unpersuasive. As pointed out in the previous Appendix (sections 6-8 on pgs. 5-9), Applicant is representing both the spin function ($Y_{0,0}$) and the orbital momentum function ($Y_{l,m}$, hereinafter denoted by $Y_{L,m}$) in the <u>same space</u> (r,t), i.e., as a single function $Y = Y_{0,0} + Y_{L,m}$ (see GUT, Eqs.I.61-1.65). This is a <u>direct contradiction</u> to Applicant's arguments in his present Response, recited on pg.57, (citation:) *"It is physically correct and mathematically*

correct to solve spin and orbital functions <u>independently</u> since there is no a priori reason, why they have to be a single eigenfunction or <u>product</u> [sic!] of eigenfunctions. After all, they are independent physical phenomena. <u>The two dimensional wave equation</u> plus time is given by McQuarrie [1]").

Most of this statement has been being practiced in science all the time by those ordinarily skilled in the art, except for one which is denoted with *"[sic!]"*. However, Applicant has obviously misinterpreted his own statement, <u>based on Applicant's own cited reference</u>, i.e., McQuarrie [1] for reasons given in the next paragraph.

The Examiner is trying to fit a square peg in a round hole and insisting that Applicant must do likewise. Applicant has derived the angular momentum of the bound electron from first principles. The Examiner relies on SQM's weird nonphysical probability wave that moves, but has no rotational energy, which is nonsense.

Applicant's derivations are given in Chp. 1 of Mills GUT. The results are used in 100's of calculations that agree remarkably with experiments as shown in Sections 54-55 and 69-70 above and in the following papers:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey,

Distributed by Amazon.com; January 2005 Edition posted at
www.blacklightpower.com.

Thus, once again Applicant has shown the Examiner to be in error. A summary
of the correct way to derive the spin and orbital charge-density functions and
corresponding angular momenta and energies is taken from:

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium
Which Predicts Conjugate Parameters from a Unique Solution for the First Time",
Annales de la Fondation Louis de Broglie, submitted is given below:

A. One-Electron Atoms

One-electron atoms include the hydrogen atom, He^+, Li^{2+}, Be^{3+},
and so on. The mass-energy and angular momentum of the electron are
constant; this requires that the equation of motion of the electron be
temporally and spatially harmonic. Thus, the classical wave equation
applies and

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]\rho(r,\theta,\phi,t) = 0 \quad (2)$$

where $\rho(r,\theta,\phi,t)$ is the time dependent charge density function of the
electron in time and space. In general, the wave equation has an infinite
number of solutions. To arrive at the solution which represents the
electron, a suitable boundary condition must be imposed. It is well known
from experiments that each single atomic electron of a given isotope
radiates to the same stable state. Thus, the physical boundary condition
of nonradiation of the bound electron was imposed on the solution of the
wave equation for the time dependent charge density function of the
electron [1-3, 5]. The condition for radiation by a moving point charge
given by Haus [26] is that its spacetime Fourier transform does possess
components that are synchronous with waves traveling at the speed of
light. Conversely, it is proposed that the condition for nonradiation by an
ensemble of moving point charges that comprises a current density
function is

*For non-radiative states, the current-density function must NOT possess
spacetime Fourier components that are synchronous with waves traveling
at the speed of light.*

The time, radial, and angular solutions of the wave equation are
separable. The motion is time harmonic with frequency ω_n. A constant
angular function is a solution to the wave equation. Solutions of the
Schrödinger wave equation comprising a radial function radiate according
to Maxwell's equation as shown previously by application of Haus'

condition [1]. In fact, it was found that any function which permitted radial motion gave rise to radiation. A radial function which does satisfy the boundary condition is a radial delta function

$$f(r) = \frac{1}{r^2} \delta(r - r_n) \quad (3)$$

This function defines a constant charge density on a spherical shell where $r_n = nr_1$ wherein n is an integer in an excited state, and Eq. (2) becomes the two-dimensional wave equation plus time with separable time and angular functions. Given time harmonic motion and a radial delta function, the relationship between an allowed radius and the electron wavelength is given by

$$2\pi r_n = \lambda_n \quad (4)$$

where the integer subscript n here and in Eq. (3) is determined during photon absorption as given in the Excited States of the One-Electron Atom (Quantization) section of Ref. [1]. Using the observed de Broglie relationship for the electron mass where the coordinates are spherical,

$$\lambda_n = \frac{h}{p_n} = \frac{h}{m_e v_n} \quad (5)$$

and the magnitude of the velocity for *every* point on the orbitsphere is

$$v_n = \frac{\hbar}{m_e r_n} \quad (6)$$

The sum of the $|\mathbf{L}_i|$, the magnitude of the angular momentum of each infinitesimal point of the orbitsphere of mass m_i, must be constant. The constant is $\hbar$.

$$\sum |\mathbf{L}_i| = \sum |\mathbf{r} \times m_i \mathbf{v}| = m_e r_n \frac{\hbar}{m_e r_n} = \hbar \quad (7)$$

Thus, an electron is a spinning, two-dimensional spherical surface (zero thickness), called an *electron orbitsphere* shown in Figure 1, that can exist in a bound state at only specified distances from the nucleus determined by an energy minimum. The corresponding current function shown in Figure 2 which gives rise to the phenomenon of *spin* is derived in the Spin Function section. (See the Orbitsphere Equation of Motion for $\ell = 0$ of Ref. [1] at Chp. 1.)

Nonconstant functions are also solutions for the angular functions. To be a harmonic solution of the wave equation in spherical coordinates, these angular functions must be spherical harmonic functions [28]. A zero of the spacetime Fourier transform of the product function of two spherical harmonic angular functions, a time harmonic function, and an unknown radial function is sought. The solution for the radial function which satisfies the boundary condition is also a delta function given by Eq. (3). Thus, bound electrons are described by a charge-density (mass-density) function which is the product of a radial delta function, two angular functions (spherical harmonic functions), and a time harmonic function.

$$\rho(r,\theta,\phi,t) = f(r)A(\theta,\phi,t) = \frac{1}{r^2}\delta(r - r_n)A(\theta,\phi,t); \qquad A(\theta,\phi,t) = Y(\theta,\phi)k(t) \quad (8)$$

In these cases, the spherical harmonic functions correspond to a traveling charge density wave confined to the spherical shell which gives rise to the phenomenon of orbital angular momentum. The orbital functions which modulate the constant "spin" function shown graphically in Figure 3 are given in the Sec. IIC.

B. Spin Function

The orbitsphere spin function comprises a constant charge (current) density function with moving charge confined to a two-dimensional spherical shell. The magnetostatic current pattern of the orbitsphere spin function comprises an infinite series of correlated orthogonal great circle current loops wherein each point charge (current) density element moves time harmonically with constant angular velocity

$$\omega_n = \frac{\hbar}{m_e r_n^2} \quad (9)$$

The uniform current density function $Y_0^0(\phi, \theta)$, the orbitsphere equation of motion of the electron (Eqs. (14-15)), corresponding to the constant charge function of the orbitsphere that gives rise to the spin of the electron is generated from a basis set current-vector field defined as the orbitsphere current-vector field ("orbitsphere-cvf"). This in turn is generated over the surface by two complementary steps of an infinite series of nested rotations of two orthogonal great circle current loops where the coordinate axes rotate with the two orthogonal great circles that serve as a basis set. The algorithm to generate the current density function rotates the great circles and the corresponding x'y'z' coordinates relative to the xyz frame. Each infinitesimal rotation of the infinite series is about the new i'-axis and new j'-axis which results from the preceding such rotation. Each element of the current density function is obtained with each conjugate set of rotations. In Appendix III of Ref. [1], the *continuous* uniform electron current density function $Y_0^0(\phi, \theta)$ having the same angular momentum components as that of the orbitsphere-cvf is then exactly generated from this orbitsphere-cvf as a basis element by a convolution operator comprising an autocorrelation-type function.

For Step One, the current density elements move counter clockwise on the great circle in the y'z'-plane and move clockwise on the great circle in the x'z'-plane. The great circles are rotated by an infinitesimal angle $\pm\Delta\alpha_i$ (a positive rotation around the x'-axis or a negative rotation about the z'-axis for Steps One and Two, respectively) and then by $\pm\Delta\alpha_j$ (a positive rotation around the new y'-axis or a positive rotation about the new x'-axis for Steps One and Two, respectively). The coordinates of each point on each rotated great circle (x',y',z') is expressed in terms of the first (x,y,z) coordinates by the following transforms where clockwise rotations and motions are defined as positive looking along the corresponding axis:

Step One

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & 0 & -\sin(\Delta\alpha_y) \\ 0 & 1 & 0 \\ \sin(\Delta\alpha_y) & 0 & \cos(\Delta\alpha_y) \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & \sin(\Delta\alpha_y)\sin(\Delta\alpha_x) & -\sin(\Delta\alpha_y)\cos(\Delta\alpha_x) \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_y) & -\cos(\Delta\alpha_y)\sin(\Delta\alpha_x) & \cos(\Delta\alpha_y)\cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

(10)

Step Two

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\sin(\Delta\alpha_z) & \cos(\Delta\alpha_z) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\cos(\Delta\alpha_x)\sin(\Delta\alpha_z) & \cos(\Delta\alpha_x)\cos(\Delta\alpha_z) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_x)\sin(\Delta\alpha_z) & -\sin(\Delta\alpha_x)\cos(\Delta\alpha_z) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

(11)

where the angular sum is $\displaystyle\lim_{\Delta\alpha \to 0} \sum_{n=1}^{\frac{\frac{\sqrt{2}}{2}\pi}{|\Delta\alpha_{i,j}|}} |\Delta\alpha_{i,j}| = \frac{\sqrt{2}}{2}\pi$.

The orbitsphere-cvf is given by n reiterations of Eqs. (10) and (11) for each point on each of the two orthogonal great circles during each of

Steps One and Two. The output given by the non-primed coordinates is the input of the next iteration corresponding to each successive nested rotation by the infinitesimal angle $\pm\Delta\alpha_{i'}$ or $\pm\Delta\alpha_{j'}$ where the magnitude of the angular sum of the n rotations about each of the i'-axis and the j'-axis is $\frac{\sqrt{2}}{2}\pi$. Half of the orbitsphere-cvf is generated during each of Steps One and Two.

Following Step Two, in order to match the boundary condition that the magnitude of the velocity at any given point on the surface is given by Eq. (6), the output half of the orbitsphere-cvf is rotated clockwise by an angle of $\frac{\pi}{4}$ about the z-axis. Using Eq. (11) with $\Delta\alpha_{z'} = \frac{\pi}{4}$ and $\Delta\alpha_{x'} = 0$ gives the rotation. Then, the one half of the orbitsphere-cvf generated from Step One is superimposed with the complementary half obtained from Step Two following its rotation about the z-axis of $\frac{\pi}{4}$ to give the basis function to generate $Y_0^0(\phi, \theta)$, the orbitsphere equation of motion of the electron.

The current pattern of the orbitsphere-cvf generated by the nested rotations of the orthogonal great circle current loops is a continuous and total coverage of the spherical surface, but it is shown as a visual representation using 6 degree increments of the infinitesimal angular variable $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ of Eqs. (10) and (11) from the perspective of the z-axis in Figure 2. In each case, the complete orbitsphere-cvf current pattern corresponds all the orthogonal-great-circle elements which are generated by the rotation of the basis-set according to Eqs. (10) and (11) where $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ approach zero and the summation of the infinitesimal angular rotations of $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ about the successive i'-axes and j'-axes is $\frac{\sqrt{2}}{2}\pi$ for each Step. The current pattern gives rise to the phenomenon corresponding to the spin quantum number. The details of the derivation of the spin function are given in Ref. [3] and Chp. 1 of Ref. [1].

The resultant angular momentum projections of $\mathbf{L}_{xy} = \frac{\hbar}{4}$ and $\mathbf{L}_z = \frac{\hbar}{2}$ meet the boundary condition for the unique current having an angular velocity magnitude at each point on the surface given by Eq. (6) and give rise to the Stern Gerlach experiment as shown in Ref. [1]. The further constraint that the current density is uniform such that the charge density is uniform, corresponding to an equipotential, minimum energy surface is satisfied by using the orbitsphere-cvf as a basis element to generate $Y_0^0(\phi, \theta)$ using a convolution operator comprising an autocorrelation-type function as given in Appendix III of Ref. [1]. The operator comprises the convolution of each great circle current loop of the orbitsphere-cvf designated as the primary orbitsphere-cvf with a second orbitsphere-cvf designated as the

secondary orbitsphere-cvf wherein the convolved secondary elements are matched for orientation, angular momentum, and phase to those of the primary. The resulting exact uniform current distribution obtained from the convolution has the same angular momentum distribution, resultant, $\mathbf{L_R}$, and components of $\mathbf{L}_{xy} = \dfrac{\hbar}{4}$ and $\mathbf{L}_z = \dfrac{\hbar}{2}$ as those of the orbitsphere-cvf used as a primary basis element.

C. Angular Functions

The time, radial, and angular solutions of the wave equation are separable. Also based on the radial solution, the angular charge and current-density functions of the electron, $A(\theta, \phi, t)$, must be a solution of the wave equation in two dimensions (plus time),

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\partial^2}{\partial t^2} \right] A(\theta,\phi,t) = 0 \quad (12)$$

where $\rho(r,\theta,\phi,t) = f(r)A(\theta,\phi,t) = \dfrac{1}{r^2}\delta(r - r_n)A(\theta,\phi,t)$ and

$A(\theta,\phi,t) = Y(\theta,\phi)k(t)$

$$\left[\frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial}{\partial\theta}\right)_{r,\phi} + \frac{1}{r^2\sin^2\theta}\left(\frac{\partial^2}{\partial\phi^2}\right)_{r,\theta} - \frac{1}{v^2}\frac{\partial^2}{\partial t^2} \right] A(\theta,\phi,t) = 0 \quad (13)$$

where v is the linear velocity of the electron. The charge-density functions including the time-function factor are

$\ell = 0$

$$\rho(r,\theta,\phi,t) = \frac{e}{8\pi r^2}[\delta(r - r_n)]\left[Y_0^0(\theta,\phi) + Y_\ell^m(\theta,\phi)\right] \quad (14)$$

$\ell \neq 0$

$$\rho(r,\theta,\phi,t) = \frac{e}{4\pi r^2}[\delta(r - r_n)]\left[Y_0^0(\theta,\phi) + \mathrm{Re}\left\{Y_\ell^m(\theta,\phi)e^{i\omega_n t}\right\}\right] \quad (15)$$

where $Y_\ell^m(\theta,\phi)$ are the spherical harmonic functions that spin about the z-axis with angular frequency ω_n with $Y_0^0(\theta,\phi)$ the constant function.
$\mathrm{Re}\left\{Y_\ell^m(\theta,\phi)e^{i\omega_n t}\right\} = P_\ell^m(\cos\theta)\cos(m\phi + \omega_n' t)$ where to keep the form of the spherical harmonic as a traveling wave about the z-axis, $\omega_n' = m\omega_n$.

D. Acceleration without Radiation

a. Special Relativistic Correction to the Electron Radius

The relationship between the electron wavelength and its radius is given by Eq. (4) where λ is the de Broglie wavelength. For each current

density element of the spin function, the distance along each great circle in the direction of instantaneous motion undergoes length contraction and time dilation. Using a phase matching condition, the wavelengths of the electron and laboratory inertial frames are equated, and the corrected radius is given by

$$r_n = r_n' \left[\sqrt{1 - \left(\frac{v}{c}\right)^2} \, \sin\left[\frac{\pi}{2}\left(1 - \left(\frac{v}{c}\right)^2\right)^{3/2}\right] + \frac{1}{2\pi}\cos\left[\frac{\pi}{2}\left(1 - \left(\frac{v}{c}\right)^2\right)^{3/2}\right] \right] \quad (16)$$

where the electron velocity is given by Eq. (6). (See Ref. [1] Chp. 1, Special Relativistic Correction to the Ionization Energies section). $\frac{e}{m_e}$ of the electron, the electron angular momentum of $\hbar$, and μ_B are invariant, but the mass and charge densities increase in the laboratory frame due to the relativistically contracted electron radius. As $v \to c$, $r/r' \to \frac{1}{2\pi}$ and $r = \lambda$ as shown in Figure 4.

b. Nonradiation Based on the Spacetime Fourier Transform of the Electron Current

The Fourier transform of the electron charge density function given by Eq. (8) is a solution of the three-dimensional wave equation in frequency space ($k, \omega \, space$) as given in Chp 1, Spacetime Fourier Transform of the Electron Function section of Ref. [1]. Then the corresponding Fourier transform of the current density function $K(s, \Theta, \Phi, \omega)$ is given by multiplying by the constant angular frequency.

$$K(s, \Theta, \Phi, \omega) = 4\pi\omega_n \frac{\sin(2s_n r_n)}{2s_n r_n} \otimes 2\pi \sum_{\upsilon=1}^{\infty} \frac{(-1)^{\upsilon-1}(\pi\sin\Theta)^{2(\upsilon-1)}}{(\upsilon-1)!(\upsilon-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(\upsilon+\frac{1}{2}\right)}{(\pi\cos\Theta)^{2\upsilon+1}2^{\upsilon+1}} \frac{2\upsilon!}{(\upsilon-1)!} s^{-2\upsilon}$$

$$\otimes 2\pi \sum_{\upsilon=1}^{\infty} \frac{(-1)^{\upsilon-1}(\pi\sin\Phi)^{2(\upsilon-1)}}{(\upsilon-1)!(\upsilon-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(\upsilon+\frac{1}{2}\right)}{(\pi\cos\Phi)^{2\upsilon+1}2^{\upsilon+1}} \frac{2\upsilon!}{(\upsilon-1)!} s^{-2\upsilon} \frac{1}{4\pi}[\delta(\omega - \omega_n) + \delta(\omega + \omega_n)]$$

$$(17)$$

$s_n \bullet v_n = s_n \bullet c = \omega_n$ implies $r_n = \lambda_n$ which is given by Eq. (16) in the case that k is the lightlike k^0. In this case, Eq. (17) vanishes. Consequently, spacetime harmonics of $\frac{\omega_n}{c} = k$ or $\frac{\omega_n}{c}\sqrt{\frac{\varepsilon}{\varepsilon_o}} = k$ for which the Fourier transform of the current-density function is nonzero do not exist. Radiation due to charge motion does not occur in any medium when this boundary condition is met. Nonradiation is also determined directly from the fields based on Maxwell's equations as given in Sec. IIDc.

c. Nonradiation Based on the Electron Electromagnetic Fields and the Poynting Power Vector

A point charge undergoing periodic motion accelerates and as a consequence radiates according to the Larmor formula:

$$P = \frac{1}{4\pi\varepsilon_0}\frac{2e^2}{3c^3}a^2 \quad (18)$$

where e is the charge, a is its acceleration, ε_0 is the permittivity of free space, and c is the speed of light. Although an accelerated *point* particle radiates, an *extended distribution* modeled as a superposition of accelerating charges does not have to radiate [21, 26, 29-31]. In Ref. [3] and Appendix I, Chp. 1 of Ref. [1], the electromagnetic far field is determined from the current distribution in order to obtain the condition, if it exists, that the electron current distribution must satisfy such that the electron does not radiate. The current follows from Eqs. (14-15). The currents corresponding to Eq. (14) and first term of Eq. (15) are static. Thus, they are trivially nonradiative. The current due to the time dependent term of Eq. (15) corresponding to p, d, f, etc. orbitals is

$$\mathbf{J} = \frac{\omega_n}{2\pi}\frac{e}{4\pi r_n^2} N[\delta(r - r_n)]\operatorname{Re}\left\{Y_\ell^m(\theta,\phi)\right\}[\mathbf{u}(t)\times\mathbf{r}]$$

$$= \frac{\omega_n}{2\pi}\frac{e}{4\pi r_n^2} N'[\delta(r - r_n)]\left(P_\ell^m(\cos\theta)\cos(m\phi + \omega_n't)\right)[\mathbf{u}\times\mathbf{r}] \quad (19)$$

$$= \frac{\omega_n}{2\pi}\frac{e}{4\pi r_n^2} N'[\delta(r - r_n)]\left(P_\ell^m(\cos\theta)\cos(m\phi + \omega_n't)\right)\sin\theta\hat{\phi}$$

where to keep the form of the spherical harmonic as a traveling wave about the z-axis, $\omega_n' = m\omega_n$ and N and N' are normalization constants. The vectors are defined as

$$\hat{\phi} = \frac{\hat{u}\times\hat{r}}{|\hat{u}\times\hat{r}|} = \frac{\hat{u}\times\hat{r}}{\sin\theta}; \qquad \hat{u} = \hat{z} = orbital\ axis \quad (20)$$

$$\hat{\theta} = \hat{\phi}\times\hat{r} \quad (21)$$

"^" denotes the unit vectors $\hat{u} \equiv \frac{\mathbf{u}}{|\mathbf{u}|}$, non-unit vectors are designed in bold, and the current function is normalized. For the electron source current given by Eq. (19), each comprising a multipole of order (ℓ,m) with a time dependence $e^{i\omega_n t}$, the far-field solutions to Maxwell's equations are given by

$$\mathbf{B} = -\frac{i}{k}a_M(\ell,m)\nabla\times g_\ell(kr)\mathbf{X}_{\ell,m}$$

$$\mathbf{E} = a_M(\ell,m)g_\ell(kr)\mathbf{X}_{\ell,m} \quad (22)$$

and the time-averaged power radiated per solid angle $\frac{dP(\ell,m)}{d\Omega}$ is

$$\frac{dP(\ell,m)}{d\Omega} = \frac{c}{8\pi k^2}|a_M(\ell,m)|^2|\mathbf{X}_{\ell,m}|^2 \quad (23)$$

where $a_M(\ell,m)$ is

$$a_M(\ell,m) = \frac{-ek^2}{c\sqrt{\ell(\ell+1)}} \frac{\omega_n}{2\pi} Nj_\ell(kr_n)\Theta\sin(mks) \quad (24)$$

In the case that k is the lightlike k^0, then $k = \omega_n/c$, in Eq. (24), and Eqs. (22-23) vanishes for

$$s = vT_n = R = r_n = \lambda_n \quad (25)$$

There is no radiation.

E. Magnetic Field Equations of the Electron

The orbitsphere is a shell of negative charge current comprising correlated charge motion along great circles. For $\ell = 0$, the orbitsphere gives rise to a magnetic moment of 1 Bohr magneton [32]. (The details of the derivation of the magnetic parameters including the electron g factor are given in Ref. [3] and Chp. 1 of Ref. [1].)

$$\mu_B = \frac{e\hbar}{2m_e} = 9.274 \times 10^{-24} \, JT^{-1} \quad (26)$$

The magnetic field of the electron shown in Figure 5 is given by

$$\mathbf{H} = \frac{e\hbar}{m_e r_n^3}(\mathbf{i}_r\cos\theta - \mathbf{i}_\theta\sin\theta) \quad \text{for } r < r_n \quad (27)$$

$$\mathbf{H} = \frac{e\hbar}{2m_e r^3}(\mathbf{i}_r 2\cos\theta + \mathbf{i}_\theta\sin\theta) \quad \text{for } r > r_n \quad (28)$$

The energy stored in the magnetic field of the electron is

$$E_{mag} = \frac{1}{2}\mu_o \int_0^{2\pi}\int_0^{\pi}\int_0^{\infty} H^2 r^2\sin\theta\, dr d\theta d\Phi \quad (29)$$

$$E_{mag\,total} = \frac{\pi\mu_o e^2 \hbar^2}{m_e^2 r_1^3} \quad (30)$$

F. Stern-Gerlach Experiment

The Stern-Gerlach experiment implies a magnetic moment of one Bohr magneton and an associated angular momentum quantum number of 1/2. Historically, this quantum number is called the spin quantum number, s $(s = \frac{1}{2}; \ m_s = \pm\frac{1}{2})$. The superposition of the vector projection of the orbitsphere angular momentum on the z-axis is $\frac{\hbar}{2}$ with an orthogonal component of $\frac{\hbar}{4}$. Excitation of a resonant Larmor precession gives rise to $\hbar$ on an axis S that precesses about the z-axis called the spin axis at the Larmor frequency at an angle of $\theta = \frac{\pi}{3}$ to give a perpendicular projection of

$$\mathbf{S}_\perp = \hbar\sin\frac{\pi}{3} = \pm\sqrt{\frac{3}{4}}\hbar\, \mathbf{i}_{Y_R} \quad (31)$$

and a projection onto the axis of the applied magnetic field of

$$S_{\|} = \hbar \cos\frac{\pi}{3} = \pm\frac{\hbar}{2}\, i_z \quad (32)$$

The superposition of the $\frac{\hbar}{2}$, z-axis component of the orbitsphere angular

momentum and the $\frac{\hbar}{2}$, z-axis component of S gives $\hbar$ corresponding to

the observed electron magnetic moment of a Bohr magneton, μ_B.

G. Electron g Factor

Conservation of angular momentum of the orbitsphere permits a discrete change of its "kinetic angular momentum" ($\mathbf{r} \times m\mathbf{v}$) by the applied

magnetic field of $\frac{\hbar}{2}$, and concomitantly the "potential angular momentum"

($\mathbf{r} \times e\mathbf{A}$) must change by $-\frac{\hbar}{2}$.

$$\Delta \mathbf{L} = \frac{\hbar}{2} - \mathbf{r} \times e\mathbf{A} \quad (33)$$

$$= \left[\frac{\hbar}{2} - \frac{e\phi}{2\pi}\right]\hat{z} \quad (34)$$

In order that the change of angular momentum, $\Delta \mathbf{L}$, equals zero, ϕ must

be $\Phi_0 = \frac{h}{2e}$, the magnetic flux quantum. The magnetic moment of the

electron is parallel or antiparallel to the applied field only. During the spin-flip transition, power must be conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \bullet (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o \mathbf{H} \bullet \mathbf{H}\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o \mathbf{E} \bullet \mathbf{E}\right] - \mathbf{J} \bullet \mathbf{E} \quad (35)$$

Eq. (36) gives the total energy of the flip transition which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively,

$$\Delta E_{mag}^{spin} = 2\left(1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2\right)\mu_B B \quad (36)$$

$$\Delta E_{mag}^{spin} = g\mu_B B \quad (37)$$

where the stored magnetic energy corresponding to the $\dfrac{\partial}{\partial t}\left[\dfrac{1}{2}\mu_o \mathbf{H} \bullet \mathbf{H}\right]$

term increases, the stored electric energy corresponding to the

$\dfrac{\partial}{\partial t}\left[\dfrac{1}{2}\varepsilon_o \mathbf{E} \bullet \mathbf{E}\right]$ term increases, and the $\mathbf{J} \bullet \mathbf{E}$ term is dissipative. The spin-

flip transition can be considered as involving a magnetic moment of g times that of a Bohr magneton. The g factor is redesignated the fluxon g factor as opposed to the anomalous g factor. Using $\alpha^{-1} = 137.03603(82)$,

the calculated value of $\frac{g}{2}$ is 1.001 159 652 137. The experimental value

[33] of $\frac{g}{2}$ is 1.001 159 652 188(4).

H. Spin and Orbital Parameters

The total function that describes the spinning motion of each electron orbitsphere is composed of two functions. One function, the spin function, is spatially uniform over the orbitsphere, spins with a quantized angular velocity, and gives rise to spin angular momentum. The other function, the modulation function, can be spatially uniform—in which case there is no orbital angular momentum and the magnetic moment of the electron orbitsphere is one Bohr magneton—or not spatially uniform—in which case there is orbital angular momentum. The modulation function also rotates with a quantized angular velocity.

The spin function of the electron corresponds to the nonradiative $n = 1$, $\ell = 0$ state of atomic hydrogen which is well known as an s state or orbital. (See Figure 1 for the charge function and Figure 2 for the current function.) In cases of orbitals of heavier elements and excited states of one electron atoms and atoms or ions of heavier elements with the ℓ quantum number not equal to zero and which are not constant as given by Eq. (14), the constant spin function is modulated by a time and spherical harmonic function as given by Eq. (15) and shown in Figure 3. The modulation or traveling charge density wave corresponds to an orbital angular momentum in addition to a spin angular momentum. These states are typically referred to as p, d, f, etc. orbitals. Application of Haus's [26] condition also predicts nonradiation for a constant spin function modulated by a time and spherically harmonic orbital function. There is acceleration without radiation as also shown in Sec. IIDc. (Also see Abbott and Griffiths, Goedecke, and Daboul and Jensen [29-31]). However, in the case that such a state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current density function since it possesses spacetime Fourier Transform components synchronous with waves traveling at the speed of light [26]. (See Instability of Excited States section of Ref. [1].)

a. Moment of Inertia and Spin and Rotational Energies

The moments of inertia and the rotational energies as a function of the ℓ quantum number for the solutions of the time-dependent electron charge density functions (Eqs. (14-15)) given in Sec. IIC are solved using the rigid rotor equation [28]. The details of the derivations of the results as well as the demonstration that Eqs. (14-15) with the results given *infra.* are solutions of the wave equation are given in Chp 1, Rotational Parameters of the Electron (Angular Momentum, Rotational Energy, Moment of Inertia) section of Ref. [1].

$\mathcal{l} = 0$

$$I_z = I_{spin} = \frac{m_e r_n^{\ 2}}{2} \quad (38)$$

$$L_z = I\omega\mathbf{i}_z = \pm\frac{\hbar}{2} \quad (39)$$

$$E_{rotational} = E_{rotational,\ spin} = \frac{1}{2}\left[I_{spin}\left(\frac{\hbar}{m_e r_n^{\ 2}}\right)^2\right] = \frac{1}{2}\left[\frac{m_e r_n^{\ 2}}{2}\left(\frac{\hbar}{m_e r_n^{\ 2}}\right)^2\right] = \frac{1}{4}\left[\frac{\hbar^2}{2I_{spin}}\right] \quad (40)$$

$$T = \frac{\hbar^2}{2m_e r_n^2} \quad (41)$$

$\mathcal{l} \neq 0$

$$I_{orbital} = m_e r_n^{\ 2}\left[\frac{\ell(\ell+1)}{\ell^2+2\ell+1}\right]^{\frac{1}{2}} = m_e r_n^{\ 2}\sqrt{\frac{\ell}{\ell+1}} \quad (42)$$

$$\mathbf{L} = I\omega\mathbf{i}_z = I_{orbital}\omega\mathbf{i}_z = m_e r_n^{\ 2}\left[\frac{\ell(\ell+1)}{\ell^2+2\ell+1}\right]^{\frac{1}{2}}\omega\mathbf{i}_z = m_e r_n^{\ 2}\frac{\hbar}{m_e r_n^{\ 2}}\sqrt{\frac{\ell}{\ell+1}} = \hbar\sqrt{\frac{\ell}{\ell+1}} \quad (43)$$

$$L_{z\ total} = L_{z\ spin} + L_{z\ orbital} \quad (44)$$

$$E_{rotational\ orbital} = \frac{\hbar^2}{2I}\left[\frac{\ell(\ell+1)}{\ell^2+2\ell+1}\right] = \frac{\hbar^2}{2I}\left[\frac{\ell}{\ell+1}\right] = \frac{\hbar^2}{2m_e r_n^{\ 2}}\left[\frac{\ell}{\ell+1}\right] \quad (45)$$

$$\langle L_{z\ orbital}\rangle = 0 \quad (46)$$

$$\langle E_{rotational\ orbital}\rangle = 0 \quad (47)$$

The orbital rotational energy arises from a spin function (spin angular momentum) modulated by a spherical harmonic angular function (orbital angular momentum). The time-averaged mechanical angular momentum and rotational energy associated with the wave-equation solution comprising a traveling charge-density wave on the orbitsphere is zero as given in Eqs. (46) and (47), respectively. Thus, the principal levels are degenerate except when a magnetic field is applied. In the case of an excited state, the angular momentum of $\hbar$ is carried by the fields of the trapped photon. The amplitudes that couple to external magnetic and electromagnetic fields are given by Eq. (43) and (45), respectively. The rotational energy due to spin is given by Eq. (40), and the total kinetic energy is given by Eq. (41).

Section 89

Examiner Souw argues on page 27 of the Appendix that:

(c. 1) Firstly, McQuarrie's spin-orbital eigenfunction $\varnothing_{100\pm}$ as defined in Eqs.8-50 and 8-5 1, is a product of the orbital eigenfunction $\varnothing_{100}$ (see Table 6-5 on pg. 224) and the spin eigenfunction á and/or â, the latter

defined independently by Eqs. 8-43 and 8-46. In contradiction to Applicant's misunderstanding, it is just because it is product, can the resulting wavefunction remain an eigenfunction of both the angular and the spin operators! Thus, that part of Applicant's statement denoted by *[sic!]* is fundamentally incorrect.

Once again, the Examiner simply argues the experimentally proven-wrong approach of SQM. Applicant uses the correct approach based on physical laws as given in Sections 82-88 above.

Section 90

Examiner Souw merely continues to make the same analysis errors in his argument on Appendix pages 27-28:

> (c.2) Secondly, Applicant's new statement cited above is a contradiction to Applicant's angular momentum (spin-orbital) wave function given in GUT, Eqs. 1.61-1.65, in which the spin wavefunction ($Y_{0,0}$) and the orbital wavefunction ($Y_{L,m}$) are both solutions of the <u>same</u> equation, and represented by one spin-orbital function in the form of an <u>addition</u> of two functions in the <u>same</u> and <u>single</u> *(r,t)* space, i.e., $YY_{0,0}+Y_{L,m}$, but <u>not</u> in two independent functions, ø=ø?á and ø=ø?â as correctly stated by McQuarrie in Eq. 8-50. What Applicant would mean with McQuarrie's *"two dimensional wave equation"* has its solution defined in a two-dimensional space as a (2-dimensional vector) functions á and â defined in McQuarrie's Eq. 8-43. These á and â are known in the art as representing two linearly independent eigenfunctions, or basis vectors, that can (but not must) be conveniently represented by á=[1,0] and â=[0, 1], which are obviously orthogonal for satisfying the orthogonality condition in Eq.8-46 on pg.300, and yet <u>fully different than -- and fully independent of-- the ordinary space</u> (r,t). (<u>Note</u>: *As generally known in the art, McQuarrie's orthogonality condition in the form of integrals over a not further-specified spin variable ó (Eq.8-46) is greatly simplified by defining --with Pauli— the spin functions á and â in its equivalent vector form, á and â, which is mathematically more elegant and also conventional).* In contrast, although Applicant's $Y_{0,0}$ is constant, it is still a function defined in the <u>same</u> and <u>single</u> space(r,t) as $Y_{L,m}$, and hence, <u>does not comply with Applicant's own new statement.</u>

The Examiner simply doesn't get it. The rules of SQM may be taught in textbooks, but the results are <u>not</u> correct. Applicant has found a different physical path that overcomes the failures of the SQM approach. In other words, Applicant agrees

with the Examiner that he is not following the mathematical postulates and rules of SQM. Rather, Applicant is deriving results based on physical laws. The agreement of predictions with observations show that SQM is wrong and CQM is right.

Applicant's solution for the spin function, which corresponds to a current, is in accord with physical laws. (This is opposed to the case of SQM, wherein the electron has current in zero dimensional space. This inescapable feature of SQM is nonsensical and corresponds to a further violation of physical laws in contradiction to the Examiner's insistence that he is following physical laws.) Superimposed on the CQM spin current is the independent spherically-harmonic charge-density wave that travels time-harmonically on the two-dimensional surface of the electron and modulates the constant spin function. The modulation function averages to zero; yet, it gives rise to orbital splitting in the presence of a magnetic field. The results match experiments exactly in contrast to the SQM predictions. Modulation is a common physical phenomenon. Ripples on traveling fluid flow, air flow, etc., and AC modulation of a DC current are just some of the infinite physical possibilities. In all cases, the modulation occurs at the same positions in space as the constant term. Thus, the reason that the Examiner believes Applicant's use of CQM gives rise to a contradiction is that SQM is nonphysical and follows mathematical rules, which, by the Examiner's own analysis, demonstrates the impossibility of modulation of a constant parameter such as current. This further proves that SQM is nonphysical, purely mathematical, and not based in the reality of the physical world.

Section 91

Examiner Souw's erroneous analysis continues on pages 28-29 of his Appendix with the following misguided statements:

> (c.3) Thirdly, Applicant has misrepresented his own cited reference [1], the latter unambiguously reciting on pg.300, "In a sense, $á= Y_{\_,+\_}$ and $â= Y_{\_,-\_}$, but this is *strictly formal* *association*, and $á$ and $â$, and even S^2 and S_z, for that matter, *do not have to be specified any further*." Thus, it is principally incorrect to interpret $Y_{\_,\pm\_}$ as being the same orbital function $Y_{L,m}$, but with $L=\_$ and $m=\pm\_$. In fact, it is mathematically impossible to do so, simply because the (bounded) solution of the pertinent differential equation requires L to be an integer (see McQuarrie [1], Eq. 6-101). It is

further recited on the next line," *The functions á and â in Eq.8-43 are called spin eigenfunctions"* ...., *which we write formally as* ..." followed by defining its orthonormal properties in Eq.8-46. As known in the art, it is sufficient and correct to define the spin functions á and â as in Eq. 8-43, together with their orthogonality condition as defined in Eq.8-46. Obviously, what is correctly meant by McQuarrie with $Y_{-,\pm}$ as *formally* representing the spin functions á and â is not $Y_{0,0}$, as insisted by Applicant in his response and in his GUT (Eqs.1.61-1.65). As generally known in the art what McQuarrie meant with á and â are the Pauli spin eigenfunctions, á[1,0] and â[0, 1], respectively, which are column vectors that should be rigorously written in columns, i.e., one component above the other (as used by the Examiner in his cited own work [3] as well by a many other authors), instead of sequential rows, i.e., one component after the other.

It is trivial to show that inputting a constant to the two-dimensional wave equation plus time gives zero. Thus, a constant function is a solution. Applicant's spin function provides for the stability of the hydrogen atom, it is relativistically invariant, and it reproduces all aspects of electron spin.

It is time to discard all of the jargon, mathematical rules, nonphysical weirdness etc., such as Pauli spin eigenfunctions, á[1,0] and â[0, 1], respectively, which are column vectors that should be rigorously written in columns, i.e., one component above the other (as used by the Examiner in his cited own work [3] as well by a many other authors), instead of sequential rows, i.e., one component after the other.

This is not physics. The Schrodinger equation did not predict spin. Then, many other theoreticians, including Dirac, tried to solve the physical electron using Maxwell's equations to give rise to electron spin. This was an obvious issue as noted by Einstein:

You know, it would be sufficient to really understand the electron.

Albert Einstein

H. Dehmelt' "Experiments with an isolated subatomic particle at rest", Reviews of Modern Physics, Vol. 62, No. 3, (1990), pp. 525-530.

The current postulate of "inherent spin" is unsatisfactory. It has caused more problems than it was solved. It is easy to appreciate that the SQM picture is not predictive. There have been many failures of the SQM picture of the electron zero-dimensions. For example:

> "They also laid to rest Wolfgang Pauli's assertions (3,6)—backed by Niels Bohr—that the spin magnetic moment of the electron could never be measured on free electrons, that is, electrons not bound to a nucleus, by means of spin-dependent changes in classical orbits. [1]

1. H. Dehmelt, "Experiments on the Structure of an Individual Elementary Particle", Science, Vol. 234, (1990), pp. 539-554.

Even the title of the article according to SQM is an impossible situation:

H. Dehmelt' "Experiments with an isolated subatomic particle at rest", Reviews of Modern Physics, Vol. 62, No. 3, (1990), pp. 525-530.

Others failed to solve this problem and desperately resorted to the "intrinsic-spin" postulate. Applicant has solved the electron physically and the results work where SQM has failed. The approach is summarized in

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted:

III. Classical Quantum Theory of the Atom Based on Maxwell's Equations

In this paper, the old view that the electron is a zero or one-dimensional point in an all-space probability wave function $\Psi(x)$ is not taken for granted. The theory of classical quantum mechanics (CQM), derived from first principles, must successfully and consistently apply physical laws on all scales [2-10]. Stability to radiation was ignored by all past atomic models. Historically, the point at which QM broke with classical laws can be traced to the issue of nonradiation of the one electron atom. Bohr just postulated orbits stable to radiation with the further postulate that the bound electron of the hydrogen atom does not obey Maxwell's equations—rather it obeys

different physics [2, 7]. Later physics was replaced by "pure mathematics" based on the notion of the inexplicable wave-particle duality nature of electrons which lead to the Schrödinger equation wherein the consequences of radiation predicted by Maxwell's equations were ignored. Ironically, Bohr, Schrödinger, and Dirac used the Coulomb potential, and Dirac used the vector potential of Maxwell's equations. But, all ignored electrodynamics and the corresponding radiative consequences. Dirac originally attempted to solve the bound electron physically with stability with respect to radiation according to Maxwell's equations with the further constraints that it was relativistically invariant and gave rise to electron spin [37]. He and many founders of QM such as Sommerfeld, Bohm, and Weinstein wrongly pursued a planetary model, were unsuccessful, and resorted to the current mathematical-probability-wave model that has many problems [1-10, 19, 22-23, 37]. Consequently, Feynman for example, attempted to use first principles including Maxwell's equations to discover new physics to replace quantum mechanics [38].

Physical laws may indeed be the root of the observations thought to be "purely quantum mechanical", and it may have been a mistake to make the assumption that Maxwell's electrodynamic equations must be rejected at the atomic level. Thus, in the present approach, the classical wave equation is solved with the constraint that a bound $n = 1$-state electron cannot radiate energy.

Herein, derivations consider the electrodynamic effects of moving charges as well as the Coulomb potential, and the search is for a solution representative of the electron wherein there is acceleration of charge motion without radiation. The mathematical formulation for zero radiation based on Maxwell's equations follows from a derivation by Haus [39]. The function that describes the motion of the electron must not possess spacetime Fourier components that are synchronous with waves traveling at the speed of light. Similarly, nonradiation is demonstrated based on the electron's electromagnetic fields and the Poynting power vector.

It was shown previously [3-8] that CQM gives closed form solutions for the atom including the stability of the $n = 1$ state and the instability of the excited states, the equation of the photon and electron in excited states, the equation of the free electron, and photon which predict the wave particle duality behavior of particles and light. The current and charge density functions of the electron may be directly physically interpreted. For example, spin angular momentum results from the motion of negatively charged mass moving systematically, and the equation for angular momentum, $\mathbf{r} \times \mathbf{p}$, can be applied directly to the wave function (a current density function) that describes the electron. The magnetic moment of a Bohr magneton, Stern Gerlach experiment, g factor, Lamb shift, resonant line width and shape, selection rules, correspondence principle, wave particle duality, excited states, reduced mass, rotational energies, and momenta, orbital and spin splitting, spin-orbital coupling, Knight shift, and spin-nuclear coupling, and elastic electron scattering from helium atoms, are derived in closed form equations based on Maxwell's equations. The calculations agree with experimental observations.

In contrast to the failure of the Bohr theory and the nonphysical, adjustable-parameter approach of quantum mechanics, multielectron atoms [4, 7] and the nature of the chemical bond [5, 7] are given by exact closed-form solutions containing fundamental constants only. Using the nonradiative wave equation solutions that describe each bound electron having conserved momentum and energy, the radii are determined from the force balance of the electric, magnetic, and centrifugal forces that correspond to the minimum of energy of the atomic or ionic system. The ionization energies are then given by the electric and magnetic energies at these radii. The spreadsheets to calculate the energies from exact solutions of one through twenty-electron atoms are available from the internet [40]. For 400 atoms and ions the agreement between the predicted and experimental results are remarkable.

Section 92

Pages 29-30 of the Souw Appendix contains the following additional errors in analysis:

This will now be mathematically proven by the Examiner in a rigorous manner. As recited in Ref. [3] already cited by the Examiner in the previous Appendix, and also in [6] as a new/independent reference (in order to convince Applicant that this Pauli matrix formulation is truly an elementary concept generally known to those ordinary skilled in the art), the Pauli spin operators are defined as (with **bold italics** denoting operators): $S_x = \_/2\ \acute{o}_x$, $S_y = \_/2\ \acute{o}_y$, $S_z = \_/2\ \acute{o}_x$, and $S^2 = \_{}^2/4\ \acute{o}^2$, with the Pauli spin matrices $\acute{o}_x$, $\acute{o}_y$, $\acute{o}_z$, and S^2 conventionally defined as

$$\acute{o}_x = 0\ 1 \qquad \acute{o}_y = 0\ \text{-}i \qquad \acute{o}_z = 1\ 0 \qquad \text{and} \qquad \acute{o}^2 = \acute{o}_x{}^2 + \acute{o}_y{}^2 + \acute{o}_z{}^2$$

$$1\ 0 \qquad\qquad i\ 0 \qquad\qquad 0\ \text{-}1$$

These Pauli spin matrices $\acute{o}$ (the **bold** print denotes its vector character) are not to be confused with the unspecified spin variable a used by McQuarrie in Eqs. 8-46. The latter will not be further used, because it has not been (and cannot be, or does not need to be) further specified, and its role has 'been adequately taken over by the vectorial properties of the Pauli spin vectors á and â. Applying these operators to McQuarrie's spin functions á(ó) and â(ó), which are now conveniently and conventionally represented by á(ó)> á=[1,0] and â(ó) > â=[0,1], both defined as column vectors and both are eigenfunctions of both $\acute{o}^2$ and $\acute{o}_z$, we easily obtain in terms of rigorous undergraduate mathematics:

$$S_z á = \_/2\ \acute{o}_z á = +\ \_/2\ á\ ;\ S_z\ â\ \acute{o}_z â = -\_/2\ â\ ;\text{and}$$

S^2 á= $\_^2/4$ ó^2 á = $\_^2/4$ (1+1+1) á = 3 $\_^2/4$ á : as well as S^2 â= $\_^2/4$ ó^2 â = $\_^2/4$ (1+1+1) â

The mathematical relations derived above are in complete agreement with the properties of McQuarrie's spin functions as defined in Eq.8-43. It has been thus proven that Applicant has misunderstood and misrepresented his own cited McQuarrie reference [1], as well as the conventional QM that traditionally makes use of Pauli spin matrices [3, 6].

Applicant does not follow the incorrect approach of SQM. Rather, he correctly solves the electron to give physical predictions that match the observations of the Stern Gerlach experiment. The object is to solve the physical problem correctly, not to follow in the deep rut of SQM mathematics that leads to the wrong physical solution. That the electron is solved correctly by Applicant using physical laws is confirmed by the fact that it is predictive. For example, Applicant's solution predicts the g factor, which is missed entirely by the Examiner's Pauli spin vectors.

In CQM, the g factor is given by a simple close-formed equation with fundamental constants only that is easily derived from the Poynting Power Theorem using the condition of conservation of angular momentum for the spin-flip transition.

ELECTRON g FACTOR

Conservation of angular momentum of the orbitsphere permits a discrete change of its "kinetic angular momentum" ($\mathbf{r} \times m\mathbf{v}$) by the applied magnetic field of $\frac{\hbar}{2}$, and concomitantly the "potential angular momentum" ($\mathbf{r} \times e\mathbf{A}$) must change by $-\frac{\hbar}{2}$.

$$\Delta \mathbf{L} = \frac{\hbar}{2} - \mathbf{r} \times e\mathbf{A} \qquad (3)$$

$$= \left[\frac{\hbar}{2} - \frac{e\phi}{2\pi} \right] \hat{z} \qquad (4)$$

In order that the change of angular momentum, $\Delta \mathbf{L}$, equals zero, ϕ must be $\Phi_0 = \frac{h}{2e}$, the magnetic flux quantum. The magnetic moment of the electron is parallel or antiparallel to the applied field only. During the spin-flip transition, power must be conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \bullet (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o \mathbf{H} \bullet \mathbf{H}\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o \mathbf{E} \bullet \mathbf{E}\right] - \mathbf{J} \bullet \mathbf{E} \tag{5}$$

Eq. (6) gives the total energy of the flip transition which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively,

$$\Delta E_{mag}^{spin} = 2\left(1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2\right)\mu_B B \tag{6}$$

$$\Delta E_{mag}^{spin} = g\mu_B B \tag{7}$$

where the stored magnetic energy corresponding to the $\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o \mathbf{H} \bullet \mathbf{H}\right]$ term increases,

the stored electric energy corresponding to the $\frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o \mathbf{E} \bullet \mathbf{E}\right]$ term increases, and the

$\mathbf{J} \bullet \mathbf{E}$ term is dissipative. The spin-flip transition can be considered as involving a magnetic moment of g times that of a Bohr magneton. The g factor is redesignated the fluxon g factor as opposed to the anomalous g factor. Using $\alpha^{-1} = 137.03603(82)$, the calculated value of $\frac{g}{2}$ is **1.001 159 652 137**. The experimental value [1] of $\frac{g}{2}$ is **1.001 159 652 188(4)**.

References for this section:

1. R. S. Van Dyck, Jr., P. Schwinberg, H. Dehmelt, "New high precision comparison of electron and positron g factors", Phys. Rev. Lett., Vol. 59, (1987), p. 26-29.

Section 93

Examiner Souw further errs in his analysis appearing on pages 30-31 of his Appendix:

> (c.4) Fourthly, on top of his misunderstanding, Applicant also has misrepresented his own McQuarrie reference by presenting $Y_{0,0}$ in place of McQuarrie's $Y_{\_,\pm\_}$ spin functions, thus leaving an incomplete set of angular momentum eigenfunctions $Y_{L,m}(è,ö)$ with L?1 by excluding $Y_{0,0}$. It is to be emphasized, McQuarrie's _formal_ $Y_{\_,\pm\_}$ is not (and never can be; therefore McQuarrie's stress on "formal") a solution of the angular

momentum eigenvalue equation, as incorrectly assumed by Applicant by misrepresenting it as $Y_{0,0}$. McQuarrie's $Y_{\_,\pm\_}$ is purely formal, and can never be a true or actual angular momentum eigenfunction, $Y_{L,m}$, in which both L and m must be integers, as generally known in the art (see also McQuarrie [1], Eq.6-101 for one-electron atom as well as Eq.6-61 for a diatomic molecule). As generally known in the art, by formally denoting the spin function with $Y_{\_,\pm\_}$, McQuarrie's set of angular momentum eigenfunctions still includes the zero orbital eigenfunction, $Y_{0,0}$. As such, McQuarrie's set of orbital eigenfunctions remains intact as a complete set of eigenfunctions, as it must always be. Obviously, Applicant's set of orbital eigenfunctions fails to comply with his own reference [1], and furthermore, violates a fundamental law of mathematics.

Again, Applicant is NOT following an INCORRECT approach.

Specifically, in response to the Examiner's statement that "McQuarrie's *formal* $Y_{\_,\pm\_}$ is not (and never can be; therefore McQuarrie's stress on "formal") a solution of the angular momentum eigenvalue equation, as incorrectly assumed by Applicant by misrepresenting it as $Y_{0,0}$. McQuarrie's," Applicant does not assert that the $Y_{1/2}$ function is a solution of the angular momentum eigenvalue equation. Applicant solves for the spin function by applying physics to the following constraints on the current. From Chp. 1 Mills GUT (Ref. #1):

Stern-Gerlach-Experiment Boundary Conditions

It is known from the Stern-Gerlach experiment that a beam of silver atoms is split into two components when passed through an inhomogeneous magnetic field. This implies that the electron is a spin 1/2 particle with an intrinsic angular momentum in the direction of the applied field (spin axis) of $\pm\frac{\hbar}{2}$, and the magnitude of the angular momentum vector which precesses about the spin axis is $\sqrt{\frac{3}{4}}\hbar$. Furthermore, the magnitude of the splitting implies a magnetic moment of μ_B, a full Bohr magneton, given by Eq. (1.99) corresponding to $\hbar$ of total angular momentum on the axis of the applied field.

The algorithm to generate the $Y_0^0(\phi,\theta)$ orbitsphere equation of motion of the electron (Eqs. (1.64-1.65)) is developed in this section. It was shown in the Angular Function section that the integral of the magnitude of the angular momentum over the orbitsphere must be constant. The constant is $\hbar$ as given by Eq. (1.57). It is shown in this section that the projection of the intrinsic orbitsphere angular momentum

onto the spin axis is $\pm\dfrac{\hbar}{2}$, and the projection onto **S**, the axis which

precesses about the spin axis, is $\hbar$ with a precessing component in the

perpendicular plane of $\sqrt{\dfrac{3}{4}}\hbar$ and a component on the spin axis of $\pm\dfrac{\hbar}{2}$.

Thus, the mystery of an intrinsic angular momentum of $\pm\dfrac{\hbar}{2}$ and a total

angular momentum in a resonant RF experiment of $L_z = \hbar$ is resolved
since the sum of the intrinsic and spin-axis projection of the precessing
component is $\hbar$. The Stern-Gerlach experiment implies a magnetic
moment of one Bohr magneton and an associated angular momentum
quantum number of 1/2. Historically, this quantum number is called the

spin quantum number, s ($s = \dfrac{1}{2}$; $m_s = \pm\dfrac{1}{2}$), and that designation is

maintained.

The electron has a measured magnetic field and corresponding
magnetic moment of a Bohr magneton and behaves as a spin 1/2 particle
or fermion. For any magnetic field, the solution for the corresponding
current from Maxwell's equations is unique. Thus, the electron field
requires a unique current according to Maxwell's equations. Several
boundary conditions must be satisfied, and the orbitsphere equation of
motion for ℓ = 0 is solved as a boundary value problem. The boundary
conditions are:

(1) each infinitesimal point (position) on the orbitsphere comprising
a charge- (mass)-density element must have the same angular and
linear velocity given by Eqs. (1.55) and (1.56), respectively;

(2) according to condition 1, every such infinitesimal point must
move along a great circle and the current-density distribution must be
uniform;

(3) the electron magnetic moment must align completely parallel or
antiparallel with an applied magnetic field in agreement with the Stern-
Gerlach experiment;

(4) according to condition 3, the projection of the intrinsic angular
momentum of the orbitsphere onto the z-axis must be $\pm\dfrac{\hbar}{2}$, and the

projection into the transverse plane must be $\pm\dfrac{\hbar}{4}$ to achieve the spin

1/2 aspect;

(5) the Larmor excitation of the electron in the applied magnetic
field must give rise to a component of electron spin angular

momentum that precesses about the applied magnetic field such that the contribution along the z-axis is $\pm\dfrac{\hbar}{2}$ and the projection onto the orthogonal axis which precesses about the z-axis must be $\pm\sqrt{\dfrac{3}{4}}\hbar$;

(6) due to conditions 4 and 5, the angular momentum components corresponding to the current of the orbitsphere and that due to the Larmor precession must rise to a total angular momentum on the applied-field axis of $\pm\hbar$;

(7) due to condition 6, the precessing electron has a magnetic moment of a Bohr magneton, and

(8) the energy of the transition of the alignment of the magnetic moment with an applied magnetic field must be given by Eqs. (1.194-1.195) wherein the g factor and Bohr magneton factors are due to the extended-nature of the electron such that it links flux in units of the magnetic flux quantum and has a total angular momentum on the applied-field axis of $\pm\hbar$.

The resulting current is uniform corresponding to Y00 that gives rise to spin angular momentum and is in agreement with all measurements of this phenomenon. The spin energy and angular momentum are calculated classically and are given in Section 88 above. The constant spin function can be modulated with a spherically and time-harmonic charge-density wave. The constant function, the modulation function, and the constant function plus the modulation function are solutions of the two-dimensional wave equation plus time. The corresponding orbital energies are given in Section 88 above.

Section 94

Examiner Souw's further argues on pages 31-32 of his Appendix that:

(c.5) Fifthly, what is correctly meant by McQuarrie with his wavefunction involving á and â is well known in the art as Pauli wavefunctions represented by 2-dimensional eigenvector with <u>components</u> ϕ^+ and ϕ^- [3, 7, 8], each of which being an independent function of (r,t), i.e., $\phi^+ = \phi_{100\_}$ (r,t), and $\phi^- = \phi_{100\_}(r,t)$, as presented by McQuarrie in Eq.8-51 on pg.301. These two independent and mutually orthogonal eigenfunctions are most conveniently written in the form of column vector components ϕ^+

= áY$_{L,m}$(r,ö)R$_{n,L}$(r) and ø⁻ = âY$_{L,m}$(r,ö)R$_{n,L}$(r), as recited in Eq.1 of the Examiner's own work [3], as well as in Ref.[7] (Eqs.5.42-47), where á=[1,0]=column vector, â=[0, 1]=column vector, Y$_{L,m}$(r,ö) is the conventional orbital angular momentum eigenfunction (=spherical harmonics, with L=0 included (see [1] Eq.6-76 on pg.215), and R$_{n,L}$(r) is the conventional radial function (=associated Laguerre function, in case of hydrogen wave function; see [1] Eq.6-102 on pg.223). The two eigenvector components ø$^{+}$ = áY$_{L,m}$R$_{n,L}$ and ø⁻ = âY$_{L,m}$R$_{n,L}$ are generally known in the art as Pauli eigenvectors (components) [3, 7].

Mathematically they are equivalent to McQuarrie's Eq.8-51, in which McQuarrie's spin functions á(ó) and â(ó) have been specifically represented by the Pauli spin vectors á and â, both satisfying the orthogonality condition as given by McQuarrie in Eq.4-46, since á?â=0=â?á, á?á=1=â?â, ?dó=1. and both also satisfying McQuarrie's eigenvalue equations 8-43.

It has been thus shown, that McQuarrie Ref. [1] perfectly agrees with the Examiner's refutation as presented in the previous Appendix as well as in Examiner's Ref.[3], whereas Applicant's GUT wavefunction does not comply with his own cited reference [1], while also violating fundamental laws of mathematics and physics. Note: Ref.[7, 8] are new citations, to show that the Pauli wave functions, ø$^{+}$ and ø⁻, are well-known and widely used in the art, as equivalents to McQuarrie's. Thus, applicant's refutation of conventional QM stems from his own misunderstanding of the subject matter, including his own cited reference [1].

The Examiner has captured the argument of SQM with its rules and representations of spin in zero dimensions, but the results are not predictive and are not in agreement with observations, as noted previously. Applicant's objective was to physically solve for real current functions that match the data (not the nonsense of current in zero-dimensional space). Applicant's solutions are predictive and match the observations. That they are different from the old formalisms (such as the Pauli spin vectors á and â, both satisfying the orthogonality condition) is expected since the old approach is NOT CORRECT.

Section 95

Examiner on Souw further argues on Appendix page 32:

This is not an *a priori* standpoint taken by the Examiner, <u>as alleged by Applicant</u>, but has been conclusively drawn from the unprecedented amount of self-contradictory and erroneous arguments of record presented by Applicant that show Applicant's complete misunderstanding of the QM.

Applicant understands SQM very well to the point that he appreciates and admits that it can not possibly be correct. Even the founders of quantum mechanics argued this as pointed out in Applicant's papers:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

Applicant was fortunate in that he had a quantum mechanics professor who was honest and taught that "SQM should be used as a tool, it is the best we can do at the moment, but it has many problems including the fact that it is not based on physical laws learned in prior courses and is not easily interpreted in terms of physical reality."

Little did he know at the time that one of his students would take an initiative to his prediction that "some day someone will replace it with the correct theory of atomic physics."

Section 96

Examiner Souw continues on page 32 of his Appendix, erroneously arguing:

> The Examiner also continues to disagree with applicant's repeated recitation (and "refutation"!) of Dirac's formulation of particle with spin _ in the form of a 4-vector (see e.g., [9] & Drell) , which is known in the art as being a natural (i.e., relativistic) extension of the 2-dimensional Pauli vector wave functions to 4-dimensional Dirac vectors that automatically represents anti-particles. Given that applicant has misunderstood Dirac's relativistic formulation, applicant's argument regarding this issue is unpersuasive.

The Dirac equation is wrong, as pointed out above and in the paper

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted:

II. Quantum Electrodynamics (QED)

Quantum mechanics failed to predict the results of the Stern-Gerlach experiment which indicated the need for an additional quantum number. In quantum mechanics, the spin angular momentum of the electron is called the "intrinsic angular momentum" since no physical interpretation exists. (Currents corresponding to the observed magnetic field of the electron can not exist in one dimension of four dimensional spacetime where Ampere's law and the intrinsic special relativity determine the corresponding unique current.) The Schrödinger equation is not Lorentzian invariant in violation of special relativity. The Schrödinger equation also misses the Lamb shift, the fine structure, and the hyperfine structure completely, and it is not stable to radiation. Quantum electrodynamics was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. But, it does not bridge the gap between quantum mechanics and special relativity. From Weisskopf [19], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; (1) does not explain nonradiation of bound electrons; (2) contains an internal inconsistency with special relativity

regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite; (3) it admits solutions of negative rest mass and negative kinetic energy; (4) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; (5) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. Dirac's postulated relativistic wave equation gives the inescapable result of a cosmological constant that is at least 120 orders of magnitude larger than the best observational limit due to the unacceptable states of negative mass for the description of the vacuum as discussed previously [2-7, 9-10][27]. The negative mass states further create an absolute "ether"-like frame in violation of special relativity which was disproved by the Michelson-Morley experiment.

In retrospect, Dirac's equation which was postulated to explain spin relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors; thus, it can not be the correct description of a bound electron even though it gives an addition quantum number interpreted as corresponding to the phenomenon of electron spin. Ironically, it is not even internally consistent with respect to its intent of being in accord with special relativity. In addition to violating Maxwell's equation with respect to stability to radiation wherein Maxwell's equations are implicit and the internal inconsistency with special relativity regarding the classical electron radius and states of negative rest mass and negative kinetic energy as given by Weisskopf [19], the Dirac equation violates Einstein causality and locality and conservation of energy as shown by the Klein Paradox discussed previously [2, 4, 7][28]. Furthermore, everyday observation demonstrates that causality and

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[27] The Rutherford experiment demonstrated that even atoms are comprised of essentially empty space [20]. Zero-point field fluctuations, virtual particles, and states of negative energy and mass invoked to describe the vacuum are nonsensical and have no basis in reality since they have never been observed experimentally and would correspond to an essentially infinite cosmological constant throughout the entire universe including regions of no mass. As given by Waldrop [21], "What makes this problem into something more than metaphysics is that the cosmological constant is observationally zero to a very high degree of accuracy. And yet, ordinary quantum field theory predicts that it ought to be enormous, about 120 orders of magnitude larger than the best observational limit. Moreover, this prediction is almost inescapable because it is a straightforward application of the uncertainty principle, which in this case states that every quantum field contains a certain, irreducible amount of energy even in empty space. Electrons, photons, quarks—the quantum field of every particle contributes. And that energy is exactly equivalent to the kind of pressure described by the cosmological constant. The cosmological constant has accordingly been an embarrassment and a frustration to every physicist who has ever grappled with it."

[28] Oskar Klein pointed out a glaring paradox implied by the Dirac equation which was never resolved [23]. "Electrons may penetrate an electrostatic barrier even when their kinetic energy, $E - mc^2$ is lower than the barrier. Since in Klein's example the barrier was infinitely broad this could not be associated with wave mechanical tunnel effect. It is truly a paradox: Electrons too slow to surpass the potential, may still only be partially reflected. ...Even for an infinitely high barrier, i.e. $r_2 = 1$ and energies $\approx 1\,MeV$, (the reflection coefficient) R is less than 75%! From (2) and (3) it appears that as soon as the barrier is sufficiently high: $V > 2mc^2$, electrons may transgress the repulsive wall—seemingly defying conservation of energy. ...Nor is it possible by way of the positive energy spectrum of the free electron to achieve complete Einstein causality."

locality always hold. Einstein also argued that a probabilistic versus deterministic nature of atomic particles leads to disagreement with special relativity. In fact, the nonlocality result of the Copenhagen interpretation violates causality as shown by Einstein, Podolsky, and Rosen (EPR) in a classic paper [22] that presented a paradox involving instantaneous (faster-than-light) communication between particles called "spooky action at a distance" which led them to conclude that quantum mechanics is not a complete or correct theory. The implications of the EPR paper and the exact Maxwellian predictions of "spooky action" and "entanglement" experiments, incorrectly interpreted in the context of quantum mechanic, are given in Chp. 37 of Ref. [7].

In 1947, contrary to Dirac's predictions, Lamb discovered a $1000\ MHz$ shift between the $^2S_{1/2}$ state and the $^2P_{1/2}$ state of the hydrogen atom [24]. This so called Lamb Shift marked the beginning of modern quantum electrodynamics. In the words of Dirac [25], "No progress was made for 20 years. Then a development came initiated by Lamb's discovery and explanation of the Lamb Shift, which fundamentally changed the character of theoretical physics. It involved setting up rules for discarding ...infinities..." Renormalization is presently believed to be required of any fundamental theory of physics [26]. However, dissatisfaction with renormalization has been expressed at various times by many physicists including Dirac [27] who felt that, "This is just not sensible mathematics. Sensible mathematics involves neglecting a quantity when it turns out to be small—not neglecting it just because it is infinitely great and you do not want it!"

Albeit, the Dirac equation did not predict the Lamb shift or the electron g factor [24, 28-29], its feature of negative-mass states of the vacuum gave rise to the postulates of QED that has become a center piece of quantum mechanics to explain these and other similar observations. One of QED's seminal aspects of renormalization which was subsequently grafted into atomic theory was a turning point in physics similar to the decision to treat the electron as a point-particle-probability wave, a point with no volume with a vague probability wave requiring that the electron have an infinite number of positions and energies including negative and infinite energies simultaneously. The adoption of the probabilistic versus deterministic nature of atomic particles violates all physical laws including special relativity with violation of causality as pointed out by Einstein [22] and de Broglie [30]. Consequently, it was rejected even by Schrödinger [31].

Pure mathematics took the place of physics when calculating subtle shifts of the hydrogen atomic energy levels. Moreover, in QED, the pure mathematics approach has been confused with physics to the point that virtual particles are really considered as causing the observable. The justification for the linkage is often incorrectly associated with the usage of series expansion and variational methods to solve problems based on physical laws. But, series expansion of an equation based on a physical action or variation of a physical

parameter of the equation versus the fabrication of an action based on fantastical untestable constructs that are represented by a series are clearly different. For example, the motion of a pendulum can be solved exactly in terms of an elliptic integral using Newtonian mechanics. Expansion of the elliptic integral in a power series and ignoring negligible terms in the series versus setting up of arbitrary rules for *discarding infinities* are clearly not the same. Furthermore, inventing virtual particles that have an action on space, and subsequently on an electron, versus expanding terms in the energy equation due to a gravitating body causing a gravitational field and thus an action on the pendulum are very different. In QED, virtual particles are not merely a sustitutional or expansion variable. They are really considered as causing the observable.

In a further exercise of poor science, virtual-particle-based calculations are even included in the determination of the fundamental constants which are circularly used to calculate the parameter ascribed to the virtual particles. For example, using the electron magnetic moment anomaly in the selection of the best value of the fine structure constant, the CODATA publication [32] reports the use of virtual particles:

"The term A1 is mass independent and the other terms are functions of the indicted mass ratios. For these terms the lepton in the numerator of the mass ratio is the particle under consideration, while the lepton in the denominator of the ratio is the virtual particle that is the source of vacuum polarization that gives rise to the term."

There is no direct evidence that virtual particles exist or that they polarize the vacuum. Even their postulation is an oxymoron.

Throughout the history of quantum theory, wherever there was an advance to a new application, it was necessary to repeat a trial-and -error experimentation to find which method of calculation gave the right answers. Often the textbooks present only the successful procedure as if it followed from first principles and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle (e.g. phenomenological Hamiltonians) to fit the empirically successful algorithm. For example, we know that it required a great deal of art and tact over decades of effort to get correct predictions out of QED. The QED method of the determination of $(g-2)/2$ from the *postulated* Dirac equation is based on a *postulated* power series of α/π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term which is processed over decades using ad hoc rules to remove infinities from each term that arises from *postulated* scores of *postulated* Feynman diagrams. The solution so obtained using the perturbation series further requires a *postulated* truncation since the series *diverges*. Mohr and Taylor reference some of the Herculean efforts to arrive at g using QED [32]:

"the sixth-order coefficient $A_1^{(6)}$ arises from 72 diagrams and is also known analytically after nearly 30 years of effort by many researchers [see Roskies, Remiddi, and Levine (1990) for a review of the early work]. It was not until 1996 that the last remaining distinct diagrams were calculated analytically, thereby completing the theoretical expression for $A_1^{(6)}$".

For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off the infinities) in one particular way and not in some other way that appears in principle equally valid. For example, Milonni [33] presents a QED derivation of the magnetic moment of the electron which gives a result of the wrong sign and requires the introduction of an

"upper limit K in the integration over $k = \omega/c$ in order to avoid a divergence."

A differential mass is arbitrarily added, then

"the choice $K = 0.42 mc/\hbar$ yields $(g-2)/2 = \alpha/2\pi$ which is the relativistic QED result to first order in α. [...] However, the reader is warned not to take these calculations too seriously, for the result $(g-2)/2 = \alpha/2\pi$ could be obtained by retaining only the first (radiation reaction) term in (3.112) and choosing $K = 3mc/8\hbar$. It should also be noted that the solution $K \cong 0.42 mc/\hbar$ of (3.112) with $(g-2)/2 = \alpha/2\pi$ is not unique."

Such an ad hoc nonphysical approach makes incredulous:

" the cliché that QED is the best theory we have!" [34]

or the statement that:

"The history of quantum electrodynamics (QED) has been one of unblemished triumph" [35].

There is a corollary, noted by Kallen: from an inconsistent theory, any result may be derived.

In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, a classical approach was explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level [2-7]. Physical laws and intuition are restored when dealing with the wave equation and quantum mechanical problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles that successfully applies physical laws on all scales. Rather than use the postulated Schrödinger boundary condition: "$\Psi \rightarrow 0$ as $r \rightarrow \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$-state electron cannot radiate energy*. The electron must be extended rather than a point. On this basis with the assumption that physical laws including Maxwell's equation apply to bound electrons, the hydrogen atom was solved exactly from first principles. The

remarkable agreement across the spectrum of experimental results indicates that this is the correct model of the hydrogen atom.

It was shown previously that quantum mechanics does not explain the stability of the atom to radiation [2]; whereas, the Maxwellian approach gives a natural relationship between Maxwell's equations, special relativity, and general relativity. CQM holds over a scale of spacetime of 85 orders of magnitude—it correctly predicts the nature of the universe from the scale of the quarks to that of the cosmos [3]. A review is given by Landvogt [36]. In a third paper, the atomic physical approach was applied to multielectron atoms that were solved exactly disproving the deep-seated view that such exact solutions can not exist according to quantum mechanics. The general solutions for one through twenty-electron atoms are given in Ref [4]. The predictions are in remarkable agreement with the experimental values known for 400 atoms and ions. A fourth paper presents a solution based on physical laws and fully compliant with Maxwell's equations that solves the 26 parameters of molecular ions and molecules of hydrogen isotopes in closed-form equations with fundamental constants only that match the experimental values [5]. In a fifth paper, the nature of atomic physics being correctly represented by quantum mechanics versus classical quantum mechanics is subjected to a test of internal consistency for the ability to calculate the conjugate observables using the same solution for each of the separate experimental measurements [6]. It is confirmed that the CQM solution is the accurate model of the helium atom by the agreement of predicted and observed conjugate parameters of the free electron, ionization energy of helium and all two electron atoms, ionization energies of multielectron atoms, electron scattering of helium for all angles, and all He I excited states using the same unique physical model in all cases. Over five hundred conjugate parameters are calculated using a unique solution of the two-electron atom without any adjustable parameters to achieve overall agreement to the level obtainable considering the error in the measurements and the fundamental constants in the closed-form equations.

In contrast, the quantum fails utterly. Ad hoc computer algorithms are used to generate meaningless numbers with internally inconsistent and nonphysical models that have no relationship to physics. Attempts are often made to numerically reproduce prior theoretical numbers using adjustable parameters including arbitrary wave functions in computer programs with precision that is often much greater (e.g. 8 significant figures greater) than possible based on the propagation of errors in the measured fundamental constants implicit in the physical problem.

In this sixth paper of a series, rather than invoking renormalization, untestable virtual particles, and polarization of the vacuum by the virtual particles, the results of QED such as the anomalous magnetic moment of the electron, the Lamb Shift, the fine structure and hyperfine structure of the hydrogen atom, and the hyperfine structure intervals of positronium and muonium (thought to be only solvable using QED) are solved exactly from

Maxwell's equations to the limit possible based on experimental measurements.

Section 97

Examiner Souw's inconsistent positions are further exposed on pages 32-33 of his Appendix, wherein he states:

> (d) On pg.65, Applicant's argument regarding dphi>inifnity dphi>2pi only reflects Applicant's misunderstanding regarding multi-valued functions. Furthermore, Applicant's wording *"in order not to violate the HUP"* does not make sense to those of ordinary skill in the art, since a constant probability density in all space having dx=inifnity does not violate the HUP at all, but is the manifestation of HUP (both äp=0?äx=? and äx=0?äp=? strictly obey the HUP, äp?äx??). The same conceptual error has been previously discussed in sub-paragraph 6(b). Such a serious misunderstanding of the HUP ultimately disqualifies Applicant's arguments altogether.

With regard to the Examiner's statement that "a constant probability density in all space having dx=inifnity does not violate the HUP at all," it is amazing that he can believe that the single electron is over all space simultaneously and instantaneously and still maintain that physical laws are not violated. The Examiner's inability to even recognize this conundrum, much less resolve it, is symptomatic of the problems with his flawed analysis.

Furthermore, with regard to the case presented in Applicant's paper 80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted, the following relevant passage provides:

> For the n=1 state, $\ell = 0$; thus, **the angular momentum according to the Schrodinger equation is exactly zero—not** $\hbar$. Furthermore, the kinetic energy of rotation K_{rot} is also **zero**. As a consequence, it is internally inconsistent for Feynman to accept the HUP which arises from the Schrodinger equation on the one hand and that the electron obeys the classical Coulomb law and is bound in an inverse squared Coulomb field

on the other. Rather than a kinetic energy of $\dfrac{\hbar^2}{2mr^2}$ which is added to the

Coulomb energy of $-\dfrac{e^2}{r}$ to get the total energy, exactly zero should be added to the Coulomb energy. This is an inescapable nonsensical result which arises from the SE directly, and it can not be saved by incorrectly assigning the angular momentum as $\hbar$ from the uncertainty relationship. Furthermore, the result that $L = K_{rot}$ = **exactly zero violates the HUP making the argument further internally inconsistent.** In addition, applying Eq. (3) to spherical harmonic solutions for Ψ with an exact momentum and energy for a given ℓ in Eqs. (11) and (12), respectively, requires that $\Delta\theta \to \infty$ since $\Delta L = 0$ in the relationship $\Delta L \Delta\theta \geq \dfrac{\hbar}{2}$. The result $\Delta\theta \to \infty$ is nonsensical. Postulating a linear combination of spherical harmonics is not consistent with a single momentum state and will not save the HUP since the linear combination is not an eigenfunction. Rather it is a wavefunction of a set that is not orthonormal (i.e. it violates QM postulates by not yielding the Kroenecker delta).

The HUP is violated. Using the Examiner's insistence that "dphi>inifnity dphi>2pi only reflects Applicant's misunderstanding regarding multi-valued functions", the insertion of 2pi in the HUP gives

$$\sigma_x \sigma_p \geq \frac{\hbar}{2}$$

$$2\pi 0 \geq \frac{\hbar}{2} \tag{6}$$

$$0 \geq \frac{\hbar}{2}$$

which is a violation as pointed out by Applicant in the previous Response.

Section 98

Examiner Souw further argues on Appendix page 33 that:

7. Applicant's misunderstanding of the Uncertainty Principle in QM

(a) Unlike the uncertainty of position and linear momentum, there is no äö>? in case of sharply defined angular momentum (äL>0), but only äö>2∂ since äö>? inevitably ends up in being confined within 2∂ due to the multiple values of the angular variable ö. Applicant's confusion in such

a simple problem is another evidence for Applicant's misunderstanding of the HUP.

Applicant is confident that there is no understanding SQM, as noted by Feynman, Dirac, and other quantum theoreticians. Furthermore, the Examiner's requirement that L=0 phi=2phi violates the HUP and shows that he has trouble with simple arithmetic, let alone understanding a theory that has defied interpretation for 80 years. See:

F. Laloë, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

Section 99

Examiner Souw further errs in his statements on Appendix page 33 that:

(b) Applicant's has failed to remove, or even properly address the Examiner's points of refutation in the previous Appendix. Consequently, said refutation remains in force, and is here re-instated by incorporation, in addition to new proofs of errors and misunderstanding encompassed in Applicant's response(s), to be detailed as follows.

Applicant notes that the problems that the Examiner is having with understanding Applicant's theory is that (1) he is mistaken in his claim that SQM uses physical laws; the mathematics of SQM violates physical laws; and (2) he tries to interpret Applicant's physical approach from the perspective of SQM with the false presumption that this approach in right, even given that SQM is alien to physical laws.

Section 100

Examiner Souw further asserts on Appendix page 33:

(c) There is no such thing as *"mathematics versus physics"* as alleged by Applicant; but rather, the two aspects always develop hand-in-hand (see section 5a(a) above). As known in the art, besides experimental evidence, physics is built on <u>rigorous</u> mathematics.

The Examiner's point does not resolve anything. There is certainly a distinction between pure mathematics and physics. There is an infinite body of mathematics that has no connection to real world physics. Mathematics is merely a tool to model physics. SQM is pure mathematics and curve-fitting. It is not predictive and has no physical meaning. SQM only produces numbers that are forced to match experimental numbers when the adjustable parameters are varied accordingly.

Section 101

Examiner Souw further states on pages 33-34 of his Appendix that:

(d) Applicant's argument regarding the Examiner's "bias by QM" is inappropriate because it is the Examiner's job to understand the scientific principles behind an invention by using tools made available to him by conventionally accepted science. QM is one of those tools that has been conventionally and objectively accepted by the scientific community. The Examiner plays no role in the scientific community's acceptance of QM.

Applicant is entitled to fair, competent, and unbiased evaluation of his application under the U.S. patent laws. Even if it is not willful intent, the Examiner's lifelong education in the field of SQM has incapacitated him from evaluating Applicant's invention, which is based on physical laws. The mastering of SQM requires a certain "suspension of belief" in physics. The Examiner's biased and corrupted myopic view is evident as pointed out in Section 99 above. Applicant believes a fair evaluation of his novel hydrogen technologyl requires the replacement of the Examiner of Record with one educated in physical laws. Perhaps, an engineer rather than a SQM theoretician, since Applicant's theory based on physical laws teaches against the nonphysical SQM.

Section 102

Examiner Souw further argues on Appendix page 34 that:

In each and every instance as evidenced by applicant's response throughout the entire prosecution history of this application, the applicant uses the competitor argument whenever his theory is refuted by any individual who provides sound mathematical and physical arguments based on conventionally accepted science such as QM to disprove

applicant's mathematically and physically flawed theory. However, it is must be emphasized that QM is not a competing theory but a conventionally accepted theory. Applicant has not provided any solid evidence that QM is flawed. All of applicant's previous arguments regarding the deficiencies of QM and attempts to disprove QM have been refuted by the Examiner in the previous and current arguments of record.

Applicant has presented many examples where SQM is flawed, as have many other noted theoreticians, including the most prominent founders of SQM as pointed out in the following papers.

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

The Examiner just chooses to ignore them.

That others use what is available even though SQM is not right does not preclude the possibility that the correct theory can or will not be found. Furthermore,

the results of CQM are unmatched by any version of SQM over its entire history. CQM gives closed-formed equations containing fundamental constants for 100's of predictions that match the experimental values with remarkable agreement, as discussed in Sections 54-55 and 69-70 above. Not a single, predictive internally consistent equation based on physics has ever been given by SQM, as discussed in the papers cited above.

Section 103

On page 34 of the Souw Appendix, the Examiner further asserts that:

> Regarding Applicant's request to have his applications examined by an Examiner who is "skilled in Maxwell equations", the MPEP states that a rejection may rely upon facts within the examiner's own/personal knowledge or other PTO employee(s); see MPEP 2 144.03(C), 37 CFR 1.1 04(c)(3) and 37 CFR 1.1 04(dX2). In this regard, the Examiner's skill in the pertinent art, both theoretical and experimental, is documented in his publication [10]. Note, the cited work has been accomplished by the Examiner 17 years ago, such that a "conflict of interest" argument is without merit.

First, it is obvious that the Examiner has not studied Applicant's "conflict of interest argument,' as his comments are non responsive. Further, it is clear that the Examiner does not have the right background when he argues that he is applying physical laws on the one hand, and then uses the HUP on the other.

The Uncertainty Principle [23. D. A. McQuarrie, *Quantum Chemistry*, University Science Books, Mill Valley, CA, (1983), pp. 135-140] is

$$\sigma_x \sigma_p \geq \frac{\hbar}{2} \tag{6}$$

where σ_x and σ_p are given by

$$\sigma_x^2 = \int \psi^* \left(\hat{X} - \langle x \rangle \right)^2 \psi dx \tag{7}$$

$$\sigma_p^2 = \int \psi^* \left(\hat{P} - \langle p \rangle \right)^2 \psi dx \tag{8}$$

The definition of the momentum operator in a *one dimensional* system is [23]

$$\hat{P}_x = -i\hbar\frac{d}{dx} \tag{9}$$

and the position operator is

$$\hat{X} = x \qquad (\text{multiply by } x) \tag{10}$$

The Uncertainty Principle is also expressed as

$$\Delta x \Delta p \geq \frac{\hbar}{2} \tag{3}$$

It is not founded on an argument about the measurement of conjugate parameters; rather it is based on the premise that reality is not definite or has no state until it is measured and the measurement device becomes entangled with the object being measured and is inseparable from it.

The Examiner states that SQM is based on physical laws. This is absolutely not true. The Examiner simply must face the reality of his belief in the Heisenberg Uncertainty Principle, requiring that all atomic objects have no physical form, that spooky action is implicit in all atomic interactions (faster than light action at a distance is predicted for all events), that atomic objects are everywhere at once (infinite number of positions and energies simultaneously, including ones of positive or negative infinity at the same instant in time), that contradictory statement must be taken as true simultaneously, that there is no causality, that time is quantized rather than continuous, even though it is disproved by the Hubble images, that every point in space contains an infinity of virtual particles that pop into and out of existence constantly, but are never observed and require a cosmological constant 120 orders of magnitude higher than the highest possible value observed, and that there are many more consequences such as infinities, Klein paradox, other paradoxes, etc. that arise.

The Examiner insists that SQM is based on physical laws. Physical laws are exact experimentally confirmed relationships. The Heisenberg Uncertainty Principle does not permit exact relationships. Thus, the following laws that are exact relationships without any uncertainty violate the Heisenberg Uncertainty Principle:

- Conservation of linear and angular momentum

- Conservation of energy

- The relativistic invariance of charge

Planck's equation

$$E = \hbar\omega = h\frac{\omega}{2\pi} = hv = hf = h\frac{c}{\lambda} \tag{2.75}$$

p, the momentum of the photon

$$\mathbf{p} = mc = \frac{E_{hv}}{c} \tag{2.77}$$

where c is the velocity of light, so that

$$M\mathbf{V} = M(\mathbf{V} + \mathbf{v}) + \frac{E_{hv}}{c} \tag{2.78}$$

And, the recoil momentum is

$$M\mathbf{v} = -\frac{E_{hv}}{c} \tag{2.79}$$

Thus, the recoil energy is given by

$$E_R = \frac{E_{hv}^2}{2Mc^2} \tag{2.80}$$

The Schwarzschild metric

$$d\tau^2 = \left(1 - \frac{2Gm_0}{c^2 r}\right)dt^2 - \frac{1}{c^2}\left[\left(1 - \frac{2Gm_0}{c^2 r}\right)^{-1} dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta d\phi^2\right] \tag{24.2}$$

Newton's Law of Gravitation for $\frac{r_g}{r_\alpha} \ll 1$

$$\mathbf{F} = \frac{Gm_1 m_2}{r^2} \tag{24.3}$$

where G is the Newtonian gravitational constant.

Maxwell's Equations

$$\nabla \times \mathbf{E} = -\frac{\partial \mu_o \mathbf{H}}{\partial t} \qquad (24.4)$$

$$\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \varepsilon_o \mathbf{E}}{\partial t} \qquad (24.5)$$

$$\nabla \bullet \varepsilon_o \mathbf{E} = \rho \qquad (24.6)$$

$$\nabla \bullet \mu_o \mathbf{H} = 0 \qquad (24.7)$$

Maxwell's Integral Laws in Free Space:

Ampere's Law

$$\oint_C \mathbf{H} \bullet d\mathbf{s} = \int_S \mathbf{J} \bullet d\mathbf{a} + \frac{d}{dt} \int_S \varepsilon_0 \mathbf{E} \bullet d\mathbf{a} \qquad (24.8)$$

Faraday's Law

$$\oint_C \mathbf{E} \bullet d\mathbf{s} = -\frac{d}{dt} \int_S \mu_0 \mathbf{H} \bullet d\mathbf{a} \qquad (24.9)$$

The Poynting power theorem:

$$\nabla \bullet (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o \mathbf{H} \bullet \mathbf{H}\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o \mathbf{E} \bullet \mathbf{E}\right] - \mathbf{J} \bullet \mathbf{E} \qquad (24.10)$$

Newtonian mechanics for $v \ll c$:

$$\mathbf{F} = \frac{d\mathbf{p}}{dt} = \frac{d(m\mathbf{v})}{dt} = m\frac{d\mathbf{v}}{dt} = m\mathbf{a} \qquad (24.11)$$

$$T = \frac{1}{2}mv^2 \qquad (24.12)$$

Special Relativity that applies when v approaches c:

$$E = mc^2 \qquad (24.13)$$

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (24.14)$$

$$l = l_o\sqrt{1 - \frac{v^2}{c^2}} \qquad (24.15)$$

$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$ (24.16)

where the subscript denotes the value in the rest frame.

The relationship between the speed of light, c, and the permittivity of free space, ε_0, and the permeability of free space, μ_0

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$ (24.28)

The fine structure constant relationship

$$\alpha = \frac{1}{4\pi} \sqrt{\frac{\mu_0}{\varepsilon_0}} \frac{e^2}{\hbar} = \frac{1}{2} \frac{\sqrt{\frac{\mu_0}{\varepsilon_0}}}{\frac{h}{e^2}} = \frac{\mu_0 e^2 c}{2h}$$ (24.29)

The relationship for the radiation resistance of free space, η.

$$\eta = \sqrt{\frac{\mu_0}{\varepsilon_0}} = 4\pi\alpha \frac{\hbar}{e^2}$$ (24.30)

The provision of a limiting speed of c for the propagation of any wave, including gravitational and electromagnetic waves and expanding spacetime.

The transition lifetime, τ, of the electric multipole moment given by

$$Q_{lm} = \frac{3}{\ell + 3} e(r_n)^\ell$$ (24.34)

of [1]

$$\tau = \frac{energy}{power}$$

$$\tau = \frac{[\hbar\omega]}{\left[\frac{2\pi c}{[(2l+1)!!]^2} \left(\frac{l+1}{l}\right) k^{2l+1} |Q_{lm} + Q'_{lm}|^2 \right]} = \frac{1}{2\pi}\left(\frac{h}{e^2}\right)\sqrt{\frac{\varepsilon_0}{\mu_0}} \frac{[(2l+1)!!]^2}{2\pi} \left(\frac{l}{l+1}\right)\left(\frac{l+3}{3}\right)^2 \frac{1}{(kr_n)^{2l}\omega}$$

(24.35)

Furthermore, in addition to failing to provide for the stability of the hydrogen atom, the Heisenberg Uncertainty Principle has been directly disproved by many observations such as those of the Hubble space telescope, interferometry experiments, and the nonexistence of an infinite cosmological constant as detailed in Applicant's paper

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

as well as the following papers:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physica Scripta, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Progress of Physics, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

Section 104

Examiner Souw errs once again in arguing on pages 34-35 of this Appendix that:

(e) Applicant's reference to Ref.[80] for alleged "failures" of HUP is unpersuasive, since Ref [80] is written by Applicant himself, and has been deemed incredible for being full of mathematical flaws and incorrect interpretations of physics principles, as previously discussed. Applicant's misinterpretation of HUP is obviously also the source for his incorrect understanding of a number of references presented on pg.65 of his Response. Beyond his blind citation of the references, Applicant has failed to identify what he meant with "inconsistency" and "paradox".

This is NOT TRUE. As shown in Sections 66-67 above, other theoreticians such as those at Princeton University agree with Applicant's arguments given in ref. # 80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted] that the Heisenberg Uncertainty Principle provides no atomic stability [E. H. Lieb, "The stability of matter", Reviews of Modern Physics, Vol. 48, No. 4, (1976), pp, 553-569.

Lieb [34] also addresses the fact that the Schrödinger equation has been accepted for over a half of a century without addressing the stability of matter. Lieb also shows that the Feynman argument is "false" due to an inappropriate application of the Heisenberg Uncertainty Principle and admonishes the misrepresentation in textbooks. By considering a wavefunction comprised of two components at two radii such that the electron can not have both sharply defined momentum and position in accordance with the Uncertainty Principle, Lieb shows that the radius can be arbitrarily small including zero such that the energy is negative infinity. This result is obviously not predictive of stability.

Furthermore, the approach by Feynman and Lieb are physically baseless. Attempts to prove that a system has a kinetic energy that exceeds some lower bound such that the total energy is not negative infinity is not based on physics since it ignores radiation-loss terms. More recently, Bugliaro at al. [35] have attempted to use QED to prove the stability of matter with N nonrelativistic electrons and K static nuclei of

nuclear charge $\leq Ze$ that can interact with photons. Here, the problem is "rigged" since the radiation field is defined to be quantized, an ultraviolet cutoff is arbitrarily imposed, Maxwell's equations are not obeyed due to the defined properties of the polarizations, and creation and annihilation operators including the limitation of the couplings of photons to electrons via Pauli operators only. Furthermore, the proof has nothing to do with the solutions of the actual atomic energy levels. Even then, stability is only found for a nuclear charge $Z \leq 6$. Thus, it is evident that neither the Schrödinger equation, variants thereof, or QED provide a general, self consistent, rigorous, and physical basis for the stability of matter.

34. E. H. Lieb, "The stability of matter", Reviews of Modern Physics, Vol. 48, No. 4, (1976), pp, 553-569.
35. L. Bugliaro, J. Fröhlich, G. M. Graf, "Stability of quantum electrodynamics with nonrelativistic matter", Physical Review Letters, Vol. 77, No. 17, (1996), pp. 3494-3497.

Furthermore, as demonstrated in Section 103 above, the implications of the HUP are not understood by the Examiner who creates a paradox between his insistence that physical laws and the HUP are both valid simultaneously.

Section 105

Examiner Souw further argues on Appendix page 35 that:

> "Inconsistency" or "paradox" exists in QM only in philosophical terms, depending on the philosophical standpoint of the individual author who made the statement, primarily with regard to what he/she defines as "reality" (cf. Laloë [5]). For example, the current Copenhagen interpretation of QM --more specifically regarding Schrödinger cat paradox, single particle interference, quantum entanglement, quantum teleportation etc.-- is neither a paradox nor inconsistency, when viewed from the philosophical standpoint of Logical Positivism [11-14] (= a modern version of Hume's classical positivism developed by the Vienna Circle --Bohr, Heisenberg, etc—, and is to date tacitly adopted by most physicists and scientists). Under this philosophical viewpoint, "reality" is defined solely as what is perceived by our five senses, as represented by experimental measurements (see, e.g., K. Nakhmanson, [11]).

In SQM, there is no reality in the absence of measurement, only math. Reality is only introduced by act of measurement, but then the measurement device is entangled with the object being measured. Then the meaning of reality is debated. Under CQM, mass, charge, electric and magnetic fields, energy, etc. are real and modeled by math. They are not math, nor do they obey math; rather they obey physics that is modeled by math. Thus, there is no need for philosophy and metaphysics.

Section 106

Examiner Souw's erroneous analysis is further exposed by his arguments on Appendix pages 35-36:

> Thus, it would be nonsense to talk about non-measurable parameters, such as suggested in the EPR paradox by some "hidden variables" and summarized in the well-known Bell's inequalities in consequence of the classical interpretation of "reality" as local realism. As of late, the Bell's theorem has been experimentally disproved in favor of the so-called Copenhagen interpretation of QM as a non-local theory [11, 15]. The Copenhagen interpretation of QM is also compatible with Pragmatism [16], which declares any knowledge on "reality", including scientific theories, as being "correct" only insofar as it is beneficial to human experience (i.e., not only capable of explaining, but also able to predict and control), the latter again referring to the five senses, or, in short, experimental measurements. The Copenhagen interpretation of QM is even compatible with Kant's metaphysics [15, 17] (foundation of modern philosophy, developed in the 18th century after Newton), which is heavily based on human reasoning (logic, mathematics) and proves that metaphysical "reality" beyond human five-sense perception is not accessible to human knowledge and/or intelligence, as described by his famous argument of "das Ding an sich", or the thing in itself.

The EPR paradox proposed by Einstein reveals that SQM is nonlocal and noncausal (predicts "spooky action" at a distance) in violation of special relativity. This is another contradiction to the Examiner's statement that he is applying physical laws, for which he has no response.

The Examiner's statement that "Bell's theorem has been experimentally disproved in favor of the so-called Copenhagen interpretation of QM as a non-local

theory [11, 15]" is specifically noted. Using CQM, with conservation of the angular momentum of the excited-state calcium atom and the emitted photons, Applicant predicts exactly in closed-form equations the results of the Aspect experiment, thus restoring locality and causality and eliminating any need for the nonsensical philosophical, metaphysical flights of fantasy or other loosening of associations, delusions of grandeur, etc. associated with SQM. See Chp 37 of Mills GUT (Ref. #1).

Section 107

Examiner Souw continues with philosophical arguments, which are found on Appendix page 36:

> In contrast, Applicant's GUT is essentially incompatible with any of those major philosophical views, since the existence of hydrino is not based on experimental evidence (= five-sense perception), and furthermore, the hydrino can not be justified by reason, for obvious violation of logic/mathematics and known laws of nature. However, it is to be emphasized, philosophy is neither a subject matter of physics nor patent examination (non-statutory subject matter). The purpose of the above discussion is just to show that Applicant has misunderstood his own cited references regarding the alleged inconsistencies and paradoxes in QM given on pg.65.

Classical physical laws, however, require no philosophy. They are directly measurably and self evident. Applicant's GUT is predictive of 100's of experimental results. The prediction of hydrino is derived from the same physical laws. It has now been observed experimentally as predicted. It is another failure of SQM that it does not predict hydrino, but this result is expected since it is not predictive of a single experimental conjugate observable and over 80 years has degraded into a philosophical, metaphysical debate.

Section 108

Examiner Souw's philosophical struggle continues on page 36 of his Appendix, wherein he argues:

It is to be emphasized, philosophy is totally irrelevant to science & technology, since it has no impact whatsoever on the "reality" itself. It does not matter whether Applicant considers single photon interference a paradox or not; a single photon that is split into different arms of an interferometer will still generate measurable interference effects. Similarly, an experiment designed to test the Bell theorem will invariably show the theorem is wrong (i.e., there is no hidden variable), no matter whether Applicant rejects a non-local QM theory as paradox, or accept QM as it is. This irrelevancy of philosophical interpretation is commonly shared by those skilled in the art, as also expressed, e.g., by Barth [18] on pg.2, col.2, lines 22-25.

Applicant has no response to the Examiner's conflict as to whether he should argue philosophy or not, or whether he thinks it is irrelevant or not. Once the Examiner takes a position, Applicant can respond.

Regardless, the results of the double-slit experiment, they are derived in closed-form equations from physical laws and appear in Chp. 8 Mills GUT. The double-slit experiment for the electron is also solved classically in Chp. 8, and the computer animation is available at:

http://www.blacklightpower.com/theory/theory.shtml

Section 109

Examiner Souw further states on Appendix page 37:

For all the reasons stated above, Applicant's contention that the conventional QM is in "serious trouble" because it allegedly entails unsolvable paradoxes and inconsistencies, hence, needs to be rejected and/or drastically revised, is totally unpersuasive.

The Examiner provides no remedy to the paradoxes of SQM which even he exposes. Rather than address them, he chooses to ignore them in a smoke screen of fluid, contradictory philosophical and metaphysical views. Why is not the existence of paradoxes grounds to even question the validity of SQM? Why is a PTO Examiner even mired in such issues? Why is he wasting Applicant's time with such existential issues? Is this practice widespread or limited to the present Applicant? Is it because Applicant used physics to solve the atom exactly and this is embarrassing to SQM

practitioners who espouse virtual particles, "spooky actions", infinities, compactified dimensions and other such fantasies? Is the Examiner trying to coerce inventors to adhere to his philosophies/religion?

With CQM, philosophical issues do not exist. It is predictive. So, why is Applicant's invention not being reviewed based on the merits and real-world data? Why the obfuscation based on the presumption that SQM is the correct theory of nature when quantum aficionados including the Examiner are incapable of characterizing reality according SQM?

The Examiner has failed to answer any of these questions.

Section 110

Examiner Souw's arguments on page 37 of his Appendix regarding spin are also without merit:

8.   Applicant's confusion regarding electron spin

Applicant has failed to address the Examiner's refutation in the previous Appendix. Applicant's spin wave function as postulated (but not derived) in GUT and repeated on pg.65-69 is mathematically flawed, since it contains mathematical inconsistencies and self-contradictions, as discussed in the previous Appendix (sect.6/pg.5-7), and more specifically in section 6 above. The Stern-Gerlach experiment has been adequately explained by Goudsmit and Uhlenbeck based on electron spin, which theoretically also agrees with the Pauli theory that represents the wavefunctions of a particle with spin 1/2 as 2-dimensional column-vector functions, ϕ^+ and ϕ^-, known in the art as Pauli wave functions [3,7]. These Pauli functions have been previously shown to be in perfect agreement with the spin functions á and â defined by Applicant's own cited reference [1]. These, however, turned out to disagree with Applicant's statement and formulations, as described above in section 6.

Not only has Applicant derived the spin function in Chp 1 and Appendix III of Mills GUT, he as also produced computer simulations that can assist the Examiner in unequivocally understanding Applicant's solution:

http://www.blacklightpower.com/theory/theory.shtml (under "Computation Files")

The results of the closed-form equations that contain fundamental constants only can not be matched by SQM. The spin function of SQM is postulated and is not predictive. It is not correct. It is nonphysical since current can not exist in zero dimensions. It posses infinite magnetic-field energy, and it misses the g factor example. Whereas, Applicant's CQM calculation matches observations to 11 figure accuracy (see Sections 88 and 92 above), the maximum limit possible based on the experimental error in the fine structure constant (the only parameter).

Section 111

Examiner Souw repeats previous errors in his arguments appearing on Appendix pages 37-38:

> Therefore, the Stern-Gerlach experiment does not need Applicant's explanation; not only because the underlying theory is incredible, but also because the explanation and prediction provided by the conventional QM is far more superior, far more quantitative and accurate, and --without falling into self-contradiction-- far more comprehensive than what Applicant has to offer. In this regard, Applicant's attempt to defend his derivation of spin-orbital wave function by combining the spin and orbital functions in one single function of (r,t) has been proven to be based on a misunderstanding over his own reference McQuarrie [1], specifically with regard to Pauli eigenfunctions, as described above and in section 6. A correct interpretation of this Pauli eigenfunctions has been demonstrated by the Examiner by successful application of the conventional QM, as evidenced by elaborate mathematical calculations of intricate line splitting and intensities that have been experimentally verified to be extremely accurate to better than 10^{-5} nm [3]. This accuracy is far more superior to the 0.1 nm accuracy of Applicant's measurements. Accordingly, Applicant's argument regarding this subject matter is totally unpersuasive.

These arguments are redundant of those found in other sections in this Response.

The current (SQM) explanation of the Stern-Gerlach experiment is postulated and physically impossible (current in zero dimensions), and it is not predictive as discussed above. CQM is in a league of its own in that is gives an exact current

distribution that reproduces all of the observations related to spin with extreme accuracy.

Section 112

Examiner Souw further argues on Appendix page 38 that:

9. Regarding "Applicant's hydrogen wave function is seriously flawed"

> Similar to most of his other remarks, here Applicant does not even try to refute the Examiner's arguments as presented in the previous Appendix, but merely re-iterate his position as already presented in his evidently flawed GUT. The incredibly-large amount of mathematical flaws and incorrect understanding of physical principles ultimately disqualifies the GUT as a scientific theory. Every argument based on GUT is therefore unpersuasive.

That the Examiner admits that Applicant has a GUT concedes a triumph over SQM which is incompatible with General Relativity and has dismaly failed in unifying physics for over 80 years. The failure to find the predicted Higgs bosom to account for the masses of fundamental particles and the disproof of the HUP by the Hubble images are just the latest in the string of failures of SQM with decades of wasted manpower and billions of wasted taxpayer dollars. While it may be difficult, the Examienr must face this fact.

In contrast, in addition to precisely predicting atomic observables in closed-form exact equations with fundamental constants only—a feat never achieved by SQM for a single example—CQM unifies the physical laws as discussed in Mills GUT (Ref. #1):

QUANTUM THEORY PAST AND FUTURE

The Schrödinger equation was originally postulated in 1926 as having a solution of the one-electron atom. It gives the principal energy levels of the hydrogen atom as eigenvalues of eigenfunction solutions of the Laguerre differential equation. But, as the principal quantum number $n \gg 1$, the eigenfunctions become nonsensical. Despite its wide acceptance, on deeper inspection, the Schrodinger solution is plagued with many failings as well as difficulties in terms of physical interpretations that have caused it to remain controversial since its inception. Only the one-electron atom may be solved without approximations, but it fails to predict electron spin, leads to models with

nonsensical consequences such as negative energy states of the vacuum, infinities, and negative kinetic energy, and it fails to predict the stability of the atomic hydrogen $n = 1$ state except for an arbitrary definition[29] [5, 17, 53, 58, 80, 94, 102, 106, 107]. In addition to many predictions which simply do not agree with observations even regarding the one-electron atom [5, 17, 53, 58, 80, 94, 102, 106, 107], the Schrödinger equation predicts noncausality, nonlocality, spooky actions at a distance or quantum telepathy, perpetual motion, and many internal inconsistencies where contradicting statements have to be taken true simultaneously. Recently, the behavior of free electrons in superfluid helium has again forced the issue of the meaning of the wavefunction. Electrons form bubbles in superfluid helium which reveal that the electron is real and that a physical interpretation of the wavefunction is necessary. Furthermore, when irradiated with light of energy of about a 0.5 to several eV [111], the electrons carry current at different rates as if they exist with different sizes. It has been proposed that the behavior of free electrons in superfluid helium can be explained in terms of the electron breaking into pieces at superfluid helium temperatures [111]. Yet, the electron has proven to be indivisible even under particle accelerator collisions at 90 GeV (LEPII). The nature of the wavefunction must now be addressed. It is time for the physical rather than the mathematical nature of the wavefunction to be determined.

A classical quantum mechanics (CQM) theory is herein derived from first principles that successfully applies physical laws on all scales. CQM gives closed form physical solutions for the electron in atoms, the free electron, and the free electron in superfluid helium. The prediction of fractional principal quantum energy states of the electron in liquid helium match the photoconductivity and mobility observations without requiring that the electron is divisible [17, 53].

In CQM, the classical wave equation is solved with the constraint that a bound electron cannot radiate energy. The mathematical formulation for zero radiation based on Maxwell's equations follows from a derivation by Haus [108]. The function that describes the motion of the electron must not possess spacetime Fourier components that are synchronous with waves traveling at the speed of light. CQM gives closed form solutions for the atom including the stability of the $n = 1$ state and the instability of the excited states, relativistic invariance of the wave equation, the equations of the photon and electron in excited states, and the equations of the free electron and photon which also predict the wave-particle duality behavior of particles and light. The current and charge-density functions of the electron may be directly physically interpreted. For example, spin angular momentum results from the motion of negatively charged mass moving systematically, and the equation for angular momentum, $\mathbf{r} \times \mathbf{p} = \hbar$, can be applied directly to the wave function (a current-density function) that describes the electron. A partial listing of well-known and documented

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[29] The Schrodinger equation can only yield integer eigenvalue solutions by selection or definition from an infinite number of possibilities since the solution is over all space with no boundary (i.e. 0 to ∞). In contrast, wave equation solutions with integers are common for boundary constrained systems such as waveguides and resonators.

phenomena which are derivable in closed form from CQM based on Maxwell's equations are given in Table 1. The calculations agree with experimental observations.

Table 1. Partial List of Physical Phenomena Solved by CQM.

• Stability of the atom to radiation	• Compton effect
• Magnetic moment of a Bohr magneton and relativistic invariance of each of $\frac{e}{m_e}$ of the electron, the electron angular momentum of $\hbar$, and the electron magnetic moment of μ_B from the spin angular momentum	• Wave-particle duality
• Stern Gerlach experiment	• Double-slit experiment for photons and electrons
• Electron and muon g factors	• Davisson Germer experiment
• Rotational energies and momenta	• Elastic electron scattering from helium atoms
• Reduced electron mass	• Ionization energies of multielectron atoms
• Ionization energies of one-electron atoms	• Hydride ion binding energy and absolute NMR shift
• Special relativistic effects	• Excited states of the helium atom
• Excited states	• Proton scattering from atomic hydrogen
• Resonant line width and shape	• Nature of the chemical bond
• Selection rules	• Bond energies, vibrational energies, rotational energies, and bond distances of hydrogen-type molecules and molecular ions, absolute NMR shift of H_2
• Correspondence principle	• Superconductivity and Josephson junction experiments
• Orbital and spin splitting	• Integral and fractional quantum Hall effects
• Stark effect	• Aharonov-Bohm effect
• Lamb Shift	• Aspect experiment
• Knight shift	• Durr experiment on the Heisenberg Uncertainty Principle
• Spin-orbital coupling (fine structure)	• Penning trap experiments on single ions
• Spin-nuclear coupling (hyperfine structure)	• Hyperfine structure interval of positronium
• Hyperfine structure interval of muonium	• Magnetic moments of the nucleons
• Nature of the free electron	• Beta decay energy of the neutron
• Nature of the photon	• Binding energy of deuterium
• Photoelectric effect	• Alpha decay

For any kind of wave advancing with limiting velocity and capable of transmitting signals, the equation of front propagation is the same as the equation for the front of a light wave. By applying this condition to electromagnetic and gravitational fields at particle production, the Schwarzschild metric (SM) is derived from the classical wave equation which modifies general relativity to include conservation of spacetime in addition to momentum and mass-energy. The result gives a natural relationship between Maxwell's equations, special relativity, and general relativity. It gives gravitation from the atom to the cosmos. The universe is time harmonically oscillatory in matter, energy, and spacetime expansion and contraction with a minimum radius that is the gravitational radius. A partial listing of the particle and cosmological phenomena derivable from CQM in closed form equations with fundamental constants only is given in Table 2.

Table 2. Partial List of Particle and Cosmological Phenomena Solved by CQM.

• Deflection of light by stars	• Power spectrum of the universe
• Precession of the perihelion of Mercury	• Microwave background temperature
• Lepton masses	• Uniformity of the microwave background radiation
• Quark masses	• Microkelvin spatial variation of the microwave background radiation measured by DASI
• Hubble constant	• Polarization of DASI data
• Age of the universe	• Observed violation of the GZK cutoff
• Observed acceleration of the expansion	• Mass density of the universe
• Power of the universe	• Large scale structure of the universe

CQM further gives the identity of dark matter which matches the criteria for the structure of galaxies and spectral lines from interstellar medium and the Sun which have been observed in the laboratory [28, 33-36, 50, 63, 67, 71, 73, 75-76, 78, 86-87, 90]. In a special case wherein the gravitational potential energy density of a blackhole equals that of the Planck mass, matter converts to energy and spacetime expands with the release of a gamma ray burst. The singularity in the SM is eliminated.

After decades of futility, QM and the Heisenberg Uncertainty Principle have not yielded a unified theory, are still purely mathematical, and have yet to be shown to be based in reality[30] [5, 17, 53, 58, 80, 94, 102, 106, 107]. Both are based on circular

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[30] From the time of its inception, quantum mechanic (QM) has been controversial because its foundations are in conflict with physical laws and are internally inconsistent. Interpretations of quantum mechanics such as hidden variables, multiple worlds, consistency rules, and spontaneous collapse have been put forward in an attempt to base the theory in reality. Unfortunately many theoreticians ignore the requirement that the wave function must be real and physical in order for it to be considered a valid description of reality. For example, regarding this issue Fuchs and Peres believe [112] "Contrary to those desires, quantum theory does *not* describe physical reality. What it does is provide an algorithm for computing

probabilities for macroscopic events ("detector ticks") that are the consequences of our experimental interventions. This strict definition of the scope of quantum theory is the only interpretation ever needed, whether by experimenters or theorists."

With Penning traps, it is possible to measure transitions including those with hyperfine levels of electrons of single ions. This case can be experimentally distinguished from statistics over equivalent transitions in many ions. Whether many or one, the transition energies are always identical within the resonant line width. So, *probabilities* have no place in describing atomic energy levels. Moreover, quantum theory is incompatible with probability theory as discussed previously [17, 107].

The Copenhagen interpretation provides another meaning of quantum mechanics. It asserts that what we observe is all we can know; any speculation about what an electron, photon, atom, or other atomic-sized entity is really or what it is doing when we are not looking is just that—speculation. The postulate of quantum measurement asserts that the process of measuring an observable forces it into a state of reality. In other words, reality is irrelevant until a measurement is made. In the case of electrons in helium, the fallacy with this position is that the "ticks" (migration times of electron bubbles) reveal that the electron is real before a measurement is made [17, 107]. Furthermore, experiments on Ba^+ in a Penning trap discussed in the Inconsistencies of Quantum Mechanics section demonstrate that the postulate of quantum measurement of quantum mechanics is experimentally disproved. These issues and other such flawed philosophies and interpretations of experiments that arise from quantum mechanics are discussed in the Retrospect section and Ref. [17, 80, 107].

QM gives correlations with experimental data. It does not explain the mechanism for the observed data. But, it should not be surprising that it gives good correlations given that the constraints of internal consistency and conformance to physical laws are removed for a wave equation with an infinite number of solutions wherein the solutions may be formulated as an infinite series of eigenfunctions with variable parameters. There are no physical constraints on the parameters. They may even correspond to unobservables or "flights of fantasy" such as probability waves, virtual particles, negative energy of the vacuum, polarization of the vacuum by virtual particles, infinities, renormalization, effective nuclear charge, ionic terms in the perturbation series, fermion propagators, virtual photon annihilation, virtual photon emission and reabsorption, virtual electron positron annihilation, photon propagators, plethora of postulated super-symmetry virtual particles which make contributions such as smuon-neutralino and sneutrino-chargino loops, neutrino oscillation, worm holes, parallel universes, hyperdimensions, parallel mind universes, quantum telepathy, entanglement, spooky actions at a distance, faster than light travel, dark energy, exotic particles comprising dark matter, the universe from nothing, big bang-inflation-deceleration-reacceleration of the universe, and so on and so on. With mathematics, it is possible to represent an infinite number of models with limitless fantasy. If you invoke the constraints of internal consistency and conformance to physical laws, quantum mechanics has never successfully solved a physical problem.

Throughout the history of quantum theory, wherever there was an advance to a new application, it was necessary to repeat a trial and error experimentation to find which method of calculation gave the right answers. Often the textbooks present only the successful procedure as if it followed from first principles; and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle to fit the empirically successful algorithm. For example, we know that it required a great deal of art and tact over decades of effort to get correct predictions out of Quantum Electrodynamics (QED). For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off the infinities) in one particular way and not in some other way that appears in principle equally valid. There is a corollary, noted by Kallen: from an inconsistent theory, any result may be derived.

Reanalysis of old experiments and many new experiments including electrons in superfluid helium challenge the Schr\O(o,¨)dinger equation predictions. Many noted physicists rejected quantum mechanics. Feynman also attempted to use first principles including Maxwell's Equations to discover new physics to replace quantum mechanics [113]. Other great physicists of the 20th century searched. "Einstein [...] insisted [...] that a more detailed, wholly deterministic theory must underlie the vagaries of quantum mechanics" [114]. He felt that scientists were misinterpreting the data. Examples of quantum mechanical misinterpretations of experiments are:

1.) The rise in current of free electrons in superfluid helium when irradiated with low-energy light and the formation of an unexpected plethora of exotic negative charge carriers in superfluid helium with mobilities greater than that of the normal electron are due to the electron breaking into fractional pieces.

2.) Virtual particles surround the electron, and as the electron's center is approached, they shield the electron's charge less effectively.

3.) Spooky actions at a distance are predicted.

4.) The purely postulated Hund's Rule and the Pauli Exclusion Principle of the assignment of unique quantum numbers to all electrons are "weird spooky action" phenomena unique to quantum mechanics that require all electrons in the universe to have instantaneous communication and coordination with no basis in physical laws such as Maxwell's equations.

5.) Since fundamental particles are probability waves and their position and energy are uncertain according to the Uncertainty Principle, they can "magically" appear on the other side of a supposedly insurmountable energy barrier based on their energy on the initial side of the barrier. Thus, they defy physical laws and tunnel through the barrier.

6.) A $^9Be^+$ ion may be in two separate locations at once.

7.) Supercurrent may go in both directions at once.

8.) Perpetual motion is predicted.

9.) A weak force is observed between the two precision machined plates with minuscule separation because the plates serve to limit the number of virtual particle modes between the plates as opposed to those outside the plates and the resulting imbalance in pressure between two infinite quantities gives rise to the feeble force known as the Casimir effect.

10.) The *postulated* Quantum Electrodynamics (QED) theory of $\dfrac{g}{2}$ is based on the determination of the terms of a *postulated* power series in α/π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term. The algorithm involves scores of *postulated* Feynman diagrams corresponding to thousands of matrices with thousands of integrations per matrix requiring decades to reach a consensus on the "appropriate" *postulated* algorithm to remove the intrinsic infinities.

11.) The muon g factor g_μ is required to be different from the electron g factor in the standard model due to the mass dependent interaction of each lepton with vacuum polarizations due to virtual particles. The BNL Muon (g-2) Collaboration used a "magic" $\gamma = 29.3$ which satisfied the BMT equation identically for the theoretical value of $\dfrac{g_\mu}{2}$ with assumption that $\dfrac{g_\mu}{2} \neq \dfrac{g_e}{2}$ and obtained a measured result that was internally consistent.

12.) The expansion of the universe is accelerating due to the presence of "dark energy" throughput all space.

13.) According to Nesvizhevsky et al. [115], a step in the transmission of falling neutrons through a variable-height channel comprising a mirror on the bottom and an absorber at the top occurred at a height of 13 μm because neutrons fell in quantized jumps.

14.) The lowest energy vibrational state of any molecule is not zero rather, in violation of the second law of thermodynamics and experimental observation such as the formation of a Bose-Einstein condensate of molecules, it is the zero order vibration of $\dfrac{1}{2}h\nu = \dfrac{1}{2}\sqrt{\dfrac{k}{\mu}}$ that is equivalent to zero point energy.

15.) Since flux is linked by a superconducting loop with a weak link in quantized units of the magnetic flux quantum, $\Phi_0 = \dfrac{h}{2e}$, the basis of superconductivity is interpreted as arising from the formation of electron pairs corresponding to the $2e$ term in the denominator; the so-called Cooper pairs form even though electrons repel each other, the electron repulsion should increase the resistance to electron flow, and such pairs can not form at

the critical temperature of high T_c superconductors.

THEN THERE IS REALITY:

1.) Fractional principal quantum energy states of the electron in liquid helium match the photoconductivity and mobility observations without requiring that the electron is divisible.

2.) The electron is an extended particle rather than a point, and the charge-density is greatest in the center.

3.) Photon momentum is conserved on a photon by photon basis rather than statistically as predicted by quantum mechanics which predicts photon coincidence counts at separated detectors (Aspect experiment).

4.) The observations that all electrons have unique quantum numbers and that the electron configuration of atoms follows a pattern based on solutions of Laplace's equation are phenomenological consequences of physical laws such as Maxwell's equations.

5.) Fundamental particles such as an electron are real, extended particles, each of size equal to its de Broglie wavelength rather than a point-particle-probability-wave. Potential energy is gained as the particle traverses the barrier which is cleared; even though, its initial kinetic energy was less than the barrier height. Energy conservation is obeyed at all times. Tunneling arises from physical laws.

6.) The fluorescence emission spectrum of a Penning trapped $^9 Be^+$ ion shows interference peaks due to coupling between oscillator modes and a Stern Gerlach transition.

7.) The energy difference of a superconducting loop observed by Friedman et al. matches the energy corresponding to the flux linkage of the magnetic flux quantum by the ensemble of superconducting electrons in their entirety with a reversal of the corresponding macroscopic current.

8.) Perpetual motion is not permitted or observed.

9.) The Casimir effect is predicted by Maxwell's equations wherein the attractive force is due only to the interactions of the material bodies themselves. Charge and current fluctuations in a material body with a general susceptibility serve as source terms for Maxwell's equations, i.e. classical fields, subject to the boundary conditions presented by the body surfaces. In the limiting case of rarefied media, the van der Waal force of interaction between individual atoms is obtained.

10.) The remarkable agreement between Eqs. (1.204) and (1.205) of the Electron g Factor section demonstrates that $\frac{g}{2}$ may be derived in closed form from Maxwell's equations in a simple straight forward manner that yields a result with eleven figure agreement with experiment—the limit of the experimental capability of the measurement of the fundamental constants that determine α.

11.) Rather than indicating an expanded plethora of postulated super-symmetry virtual particles which make contributions such as smuon-neutralino and sneutrino-chargino loops, the muon, like the electron, is a lepton with $\hbar$ of angular momentum, and the muon and electron g factors are predicted by CQM to be identical. Using the experimental "magic" $\gamma = 29.3$ and $\frac{g_\mu}{2} = \frac{g_e}{2}$ in the BMT equation, the predicted measurement exactly matched $\frac{g_\mu}{2}$ measured by the BNL Muon (g-2) Collaboration proving that their assumption that the $\gamma = 29.3$ condition eliminated the effect of the electrostatic field on ω_a was flawed and showed the equivalence of the muon and electron g factors.

12.) The constant maximum speed, c, for the propagation of light and gravity results in the conservation relationship of

arguments that the electron is a probability wave requiring that the electron have multiple positions and energies including negative and infinite energies simultaneously. Both are postulated, cannot be proven experimentally, and predict consequences such as violation of conservation of energy and momentum and an essentially infinite cosmological constant [17, 80, 102, 106, 107] and Ref. [116]. These predictions are not in agreement with experimentation. Furthermore, it was recently proven experimentally that the Heisenberg Uncertainty principle has nothing to do with wave-particle duality as shown in Refs. [17, 80, 107], the Wave-Particle Duality is Not Due to the Uncertainty Principle section, and Ref. [117]; whereas, the opposite is largely touted as one of its triumphs.

In contrast, the predictions of CQM are unprecedented in that agreement with observations is achieved over 85 orders of magnitude from the scale of fundamental particles to that of the cosmos. Observable features of atomic particles such as the electron g factor may be calculated in closed form from Maxwell's equations with 11 figure accuracy without invoking the vagaries and inconsistencies inherent with QM and the Heisenberg Uncertainty Principle.

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mass-energy, $E = mc^2$ and spacetime, $\dfrac{c^3}{4\pi G} = 3.22 \, X \, 10^{34} \, \dfrac{kg}{sec}$. Spacetime expands as mass is converted to energy, and the predictions match the observed Hubble constant and the acceleration of the expansion.

13.) The de Broglie wavelength in the vertical direction corresponding to the scattering of a falling neutron from the mirror to the absorber was given by $\lambda = z_1 = \dfrac{1}{2}\left(\dfrac{h}{m_n}\right)^{2/3} (g)^{-1/3} = 12.6 \, \mu m$ where h is Planck's constant, m_n is the mass of the neutron, and g is the acceleration due to gravity. For absorber heights greater than $13 \, \mu m$, the height was greater than the de Broglie wavelength; thus, a step in the transmission of failing neutrons occurred at $13 \, \mu m$. The observed transmission matched identically that predicted by Newton's Law of Gravitation; no quantum gravity effect was observed.

14.) The lowest energy vibrational state of any molecule is zero as its lowest vibrational and rotational energies, and the molecules can be solved using first principles in closed form equations in agreement with experimental observations including the difference in bond energies and vibrational energies with isotopes substitution.

15.) To conserve the electron's invariant angular momentum of $\hbar$, flux is linked by each electron in quantized units of the magnetic flux quantum, $\Phi_0 = \dfrac{h}{2e}$, and the basis of superconductivity is a correlated flow of an ensemble of individual electrons such that no energy is dissipated (i.e. superconductivity arises when the lattice is a band-pass for the magnetic field of an array of magnetic dipoles; so, no energy is dissipated with current flow).

CQM explains the data based on reality versus fantastical interpretations of probability wave equation solutions. These examples are given in Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality, Appendix IV: Muon g Factor, the Retrospect section, the Gravity section, and Refs. [5, 17, 53, 58, 80, 94, 102, 106, 107]. Tunneling phenomena are derived in the Alpha Decay section and the Schrödinger Fat Cats—Another Flawed Interpretation section.

OUTLINE OF THE RESULTS OF THE UNIFIED THEORY DERIVED FROM FIRST PRINCIPLES

To overcome the limitations of quantum mechanics, physical laws which are exact on all scales are sought. Rather than engendering the electron with a wave nature as suggested by the Davisson-Germer experiment and fabricating a set of associated postulates and mathematical rules for wave operators, a new theory is derived from first principles.

Foundations:

- Physical laws apply on all scales (especially Maxwell's)

- Absolute internal consistency even between widely different phenomena,

- Conservation of linear and angular momentum,

- Charge conservation,

- First and second law of thermodynamics,

- Constant maximum of the speed of light in a vacuum,

- Special relativity with Newton's laws in the low speed limit,

- Conservation of matter/energy,

- General relativity derived from Maxwell's equations using the constant maximum propagation of any signal including the gravitational field which gives the Schwarzschild metric and conservation of spacetime as well as matter/energy with no cosmological constant; Newtonian gravitation in the weak field limit which forbids a cosmological constant,

- A vacuum is a vacuum,

- 4 dimensional spacetime, and

- The only allowed parameters are the measured fundamental constants.

The novel theory of Classical Quantum Mechanics (CQM) unifies Maxwell's Equations, Newton's Laws, and General and Special Relativity. The closed form calculations of a broad spectrum of fundamental phenomena containing fundamental constants only are given in subsequent sections. CQM gives closed form solutions for the atom which give four quantum numbers, the Rydberg constant, the stability of the

$n = 1$ state and the instability of the excited states, relativistic invariance of the wave equation, the equations of the photon and electron in excited states, the equations of the free electron, and photon which predict the wave particle duality behavior of particles and light. The current and charge-density functions of the electron may be directly physically interpreted. For example, spin angular momentum results from the motion of negatively charged mass moving systematically, and the equation for angular momentum, $\mathbf{r} \times \mathbf{p} = \hbar$, can be applied directly to the wave function (a current-density function) that describes the electron. The magnetic moment of a Bohr magneton, Stern Gerlach experiment, electron and muon g factors, fine structure splitting, Lamb shift, hyperfine structure, muonium hyperfine structure interval, resonant line width and shape, selection rules, correspondence principle, wave particle duality, excited states, reduced mass, rotational energies and momenta, spin-orbital coupling, Knight shift and spin-nuclear coupling, closed form solutions for one, two, and three electron atoms, excited states of the helium atom, elastic electron scattering from helium atoms, proton scattering from atomic hydrogen, the nature of the chemical bond, bond energies, vibrational energies, rotational energies, and bond distances of hydrogen-type molecules and molecular ions, Davisson Germer experiment, Aspect experiment, Durr experiment on the Heisenberg Uncertainty Principle, Penning trap experiments on single ions, hyperfine structure interval of positronium, magnetic moments of the nucleons, beta decay energy of the neutron, the binding energy of deuterium, and alpha decay are derived in closed form equations based on Maxwell's equations. The theory of collective phenomena including statistical mechanics, superconductivity and Josephson junction experiments, integral and fractional quantum Hall effects, and the Aharonov-Bohm effect is given. The calculations agree with experimental observations.

From the closed form solution of the helium atom, the predicted electron scattering intensity is derived. The closed form scattering equation matches the experimental data; whereas, calculations based on the Born model of the atom utterly fail at small scattering angles. The implications for the invalidity of the Schrödinger and Born models of the atom and the dependent Heisenberg Uncertainty Principle are discussed.

For any kind of wave advancing with limiting velocity and capable of transmitting signals, the equation of front propagation is the same as the equation for the front of a light wave. By applying this condition to electromagnetic and gravitational fields at particle production, the Schwarzschild metric (SM) is derived from the classical wave equation which modifies general relativity to include conservation of spacetime in addition to momentum and matter/energy. The result gives a natural relationship between Maxwell's equations, special relativity, and general relativity. It gives gravitation from the atom to the cosmos. The gravitational equations with the equivalence of the particle production energies permit the equivalence of mass-energy and the spacetime wherein a *"clock" is defined that measures "clicks" on an observable in one aspect, and in another, it is the ruler of spacetime of the universe with the*

implicit dependence of spacetime on matter-energy conversion. The masses of the leptons, the quarks, and nucleons are derived from this metric of spacetime. The universe is time harmonically oscillatory in matter, energy, and spacetime expansion and contraction with a minimum radius that is the gravitational radius. In closed form equations with fundamental constants only, CQM gives the basis of the atomic, thermodynamic, and cosmological arrows of time, the deflection of light by stars, the precession of the perihelion of Mercury, the Hubble constant, the age of the universe, the observed acceleration of the expansion, the power of the universe, the power spectrum of the universe, the microwave background temperature, the primary uniformity of the microwave background radiation, the polarization and microkelvin temperature spatial variation of the microwave background radiation measured by DASI, the observed violation of the GZK cutoff, the mass density of the universe, the large scale structure of the universe, and the identity of dark matter which matches the criteria for the structure of galaxies and spectral lines from interstellar medium and the Sun which have been observed in the laboratory [25-26]. In a special case wherein the gravitational potential energy density of a blackhole equals that of the Planck mass, matter converts to energy and spacetime expands with the release of a gamma ray burst. The singularity in the SM is eliminated.

Section 113

Examiner Souw repeats the following previously flawed arguments on pages 38-39 of his Appendix:

10. Regarding Applicant's incorrect application of Einstein's Special Relativity

Applicant's repeat of his GUT derivation is unpersuasive, since it does not address the Examiner's point of refutation as brought up the previous Appendix. The Examiner's refutation was/is, that Applicant's application of Einstein's Relativity Theory to an orbiting electron is fundamentally wrong, since such a system is not an inertial system, and hence, the Lorentz contraction is not applicable. There appears to be a lack of appreciation by the applicant of the crucial difference between inertial systems and non-inertial systems, which is most fundamental to Einstein's Relativity Theory. Therefore, Applicant's entire argument is unpersuasive.

These arguments are redundant of those rebutted in previous Sections of this Response (see, e.g., Sections 55 and 81 above).

Section 114

Examiner Souw asserts on page 39 of his Appendix that:

11.   Applicant's failure to respond to specific refutations in the original Souw Appendix

Besides Applicant's failure to persuasively argue against the Examiner's refutation of GUT as raised in the original Appendix, Applicant has left these points un-responded:

(a) Applicant's misinterpretation of the radial function in QM that allegedly goes straight through the nucleus, which is raised by the Examiner in sect. 9 of the original Appendix.

According to SQM textbooks, the electron is in the nucleus. A theory of the hydrogen atom can not be correct if it requires that the electron is in the nucleus. Thus, SQM is fatally flawed as discussed in Ref. # 17 and 80. A valid theory can not permit the electron to "spiral into the nucleus". However, an inescapable fact of SQM is that the wave function solution of the SE requires that **the electron is in the nucleus** [17, 80]. In fact, the electron must exist in the nucleus since the wave function is a maximum there. This is clearly claimed in the literature as discussed by Karplus to explain the spin-nuclear coupling called Fermi contact interaction for example [M. Karplus and R. N. Porter, *Atoms and Molecules an Introduction for Students of Physical Chemistry*, The Benjamin/Cummings Publishing Company, Menlo Park, California, (1970), p. 567]. In fact, the probability density function Ψ^2 has a maximum at the nucleus for the n=1 state, and the nucleus has a finite volume. Griffiths gives the time average that the electron is in the nucleus [D. J. Griffiths, *Introduction to Quantum Mechanics*, Prentice-Hall, (1995), Prob. 4.14]. This situation corresponds to infinite energy using Feynman's correct assertion [80] that the Coulomb potential must apply to the interaction of the electron and the nucleus.

Section 115

Examiner Souw further repeats previously rebutted arguments on Appendix page 39:

(b) The Examiner's invitation for Applicant to use his GUT to calculate line intensities that are verifiable by experimental measurement, as done by the examiner in his two cited own works [3, 4] remains un-responded.

These arguments are redundant having already been disposed of in Section 59 above.

Section 116

Examiner Souw concludes his error-plagued Appendix with additional erroneous statements on pages 39-40:

Conclusion:

Applicant's response has failed to remove the Examiner's points of refutation as brought in the original Souw Appendix, some of which having been improperly addressed, or even left-out un-addressed. Consequently, all points of the Examiner's refutation remain in force, and are re-instated herein by incorporation, in addition to the above new proofs of Applicant's errors and misunderstanding brought up in his response(s). The Examiner does not evaluate GUT from an exclusive viewpoint of QM, as alleged by Applicant, but takes account of the fact that GUT is trying to disagree with QM, i.e., by fully considering every point of Applicant's arguments. Thus, the Examiner has evaluated the GUT on its own merit based on its scientific credibility, i.e., its validity with regard to mathematical basis and experimental evidence. It was found, none of the criteria required by the conventional standard for scientific theory and/or patentable invention has been fulfilled.

As indicated by the independent reviews listed above in Section 54 and some of the stunning results of closed-form equations presented above in Sections 54-55 and the attached tables:

Tables summarizing the results of the calculated and experimental parameters of H_2, D_2, H_2^+ and D_2^+, one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, and twenty-electron atoms, the excited states of helium, the electron g factor, and

relations between fundamental particles. The closed-form derivations from
Maxwell's equations given in

The Grand Unified Theory of Classical Quantum Mechanics posted at
http://www.blacklightpower.com/bookdownload.shtml

contain fundamental constants only. The nature of the chemical bond is given in
Chp. 12. The atoms are solved exactly in Chps. 1, 7, and 10. The excited states
of helium are solved exactly in Chp. 9. The electron g factor and relations
between fundamental particles are given in Chp. 1 and Chps. 27 and 30,
respectively.

These results can not be replicated by SQM, nor can CQM's extraordinary predictiveness. The successes over 85 orders of magnitude of scale demonstrate that CQM is the correct physics of nature from the scale of the quarks to the cosmos. It successfully predicted the mass of the top quark, the acceleration of the expansion of the universe, and the characteristics of hydrino that have been verified in over 112 journal articles and 51 independent reports and journal articles.

The Examiner is blinded by his biases that he can not even appreciate. His argument that he is applying physical laws while defending the validity of the HUP is contradictory and indicative of his bias or incapacity to understand the conflict. Even more troubling is the Examiner's degradation to philosophical and metaphysical debates. This is inappropriate for a PTO official and has unfairly delayed allowance of this case.

Section 117

Examiner Souw further errouneously argues on Appendix page 4 that:

On pages 105-106 of applicant's 188 page response filed on 10/22/2004, applicant asserts that there is an enormous body of additional theoretical

support that applicant has submitted for the new states of hydrogen and that the applicant has provided an enormous body of experiment evidence that lower-energy hydrogen states are produced by the disclosed catalytic reaction. However, this assertion is unrelated to the Examiner's argument that there is no theoretical or experimental support for new forms of one electron atoms having an atomic mass of at least four and having an increased binding energy greater than the binding energy of the corresponding ordinary one electron atom because these new forms of one electron atoms having an atomic mass of at least four are not hydrino atoms. Nevertheless, since applicant uses the same mathematically and scientifically flawed theory of the hydrino atom as theoretical support for one-electron atoms having an atomic mass of at least four and having an increased binding energy greater than the binding energy of the corresponding ordinary one electron atom, the Examiner remains unpersuaded that these novel forms of one electron atoms are theoretically supported or actually exist for the same reasons of record given for the hydrino atom.

Given the overwhelming body of evidence for hydrino (lower-energy states of a one-electron atom) cited in the 112 journal articles and 51 independent reports and journal articles, as well as the unprecedented predictability of the Mills GUT as discussed above, including Sections 54-55, 69-70, 112 and 115, the existence of the general case of lower-energy states of one-electron atoms is also established.

Section 118

Examiner Souw again errs in stating on page 4 of the Appendix that:

On page 111 of the response, applicant asserts that there is no contradiction with respect to the enthalpy of reaction of the catalyst ~ throughout his specification. The Examiner remains unpersuaded because the applicant is now introducing new matter and arbitrary values into his postulated equations (not derived as explained in previous Office Actions) in order to explain his contradictions in his original disclosure.

Applicant has adequately and consistently disclosed the enthalpy of reaction of the catalyst throughout his specification. The two possibilities of $m/2 \times 27.2$ eV and $m \times 27.2$ eV, where in both cases m is an integer, are subsets of each other. This allows for the possibility that: (1) the catalyst increases the central-field interaction by an integer followed by a further release of energy of an integer multiple of 13.6 eV as

derived in Mills GUT and disclosed in the specification; (2) provides for the possibility that multiple species each with an ionization energy of 13.6 eV such as atomic hydrogen or oxygen can serve as the catalyst in aggregate, and (3) the possibly that the catalyst accepts the entire energy of the transition between the initial and final states. An example of a catalyst of case (3) for the transition between the n=1 to the n=1/2 states of atomic hydrogen that was presented in the last Response of 10/22/04 is Ne+.

For all of the foregoing reasons, Examiner Souw's rejections should be withdrawn and this case allowed.

APPLICANT'S RESPONSE TO THE SECRET COMMITTEE'S CONSOLIDATED APPENDIX OF EXAMINER'S RESPONSES OF RECORD TO APPLICANT'S ARGUMENTS OF RECORD FILED IN U.S. APP'N SER. NO. 09/669,887 AND INCORPORATED INTO THE PRESENT RESPONSE IN U.S. APP'N SER. NO. 09/110,717.

The Secret Committee's aptly named "Consolidated Appendix" is just a repackaging of mostly old, tired arguments—many thought to be long abandoned or otherwise disposed of—that do more to undercut the Committee's rejections in this case than to support them. As shown below, these arguments erroneously raise a hodgepodge of new standards, double standards, or oftentimes no standards at all, that amount to flimsy excuses for refusing to fairly consider the considerable record evidence in this case.

The Committee's analysis of the utility and enablement of Applicant's disclosed technology erroneously starts with the false premise that lower energy states are "incredible" based on the misguided notion that quantum theory and the underlying Schrodinger equation prohibit energy levels below the ground state. This faulty analysis is taken apart not only by Applicant's detailed responses herein, but also by the Committee's own admissions, for instance, that the Schrodinger equation fails to account for spin and relativity, and thus is only "fundamentally correct." These admissions are consistent with those by the Committee's lead Examiner, BMS President Souw, who concedes that quantum theory "needs improvement" and that the existence of lower energy states "is not impossible."

Despite the obvious inconsistencies in its multiple positions, the Committee commits grievous errors with its farfetched assertions that elevate flawed, outdated quantum theory to the status of a physical law that cannot be violated. The Committee compounds its error in labeling as "incredible" Applicant's more advanced, modern theory that accounts for lower energy states and then using that label as an excuse to ignore Applicant's confirming evidence. That the Committee would continue to advance these fatally flawed theoretical arguments to avoid considering the evidence is what's incredible, not the existence of these lower energy states.

While Applicant has willingly engaged the Committee in this theoretical debate,

irrespective of Applicant's theory or how he discovered lower energy states, he is entitled to have his experimental evidence—which now includes 65 peer-reviewed articles published in esteemed scientific journals—fairly considered. It cannot be considered fair when, to the exclusion of that evidence, the Committee adopts the biased arguments of its lead Examiner, who is the founder and current President of BMS Enterprise, a company that competes with Applicant, and who relies on an outdated theory that even he admits "needs improvement" to suggest the existence of lower energy states is "incredible." The unfounded conclusions that make up the arguments contained in the Committee's "Consolidated Appendix" are no substitute for evidence and thus are incapable of rebutting the overwhelming scientific evidence of record in this case.

On page 4 of the Consolidated Appendix, the Committee incorrectly asserts that:

> Applicant has presented a theory of the "hydrino atom" and has alleged that his submitted experimental results could be interpreted in terms of the energy states of the "hydrino atom." Applicant's arguments, declarations, and experimental data filed to date have been fully considered by the examiner but they are not persuasive for the reasons of record.

The Committee's statement that it has "fully considered" Applicant's experimental evidence of record is shown to be blatantly false by the many flimsy excuses for "disqualifying" and ignoring that evidence in this and the other Attachment. Disqualifying and ignoring experimental data is not the same as "fully considering" it.

Applicant further notes that, on page 4 of the Consolidated Appendix, the Committee states that:

> For applicant's convenience, the consolidated appendix incorporates some of the main points from all the appendices attached to previous office actions of record and from the Examiner's present arguments and previous arguments of record. All arguments from previous Office actions of record and attached appendices therein are herein incorporated by reference in their entirety.

Similarly, many of Applicant's prior Responses are incorporated herein by reference in their entirety, as those Responses address many of the same repetitive points erroneously raised by the Committee in its Consolidated Appendix. Applicant further notes the Committee's tendency to gloss over his detailed arguments or ignore

them altogether, which arguments therefore stand unrefuted.

On page 4 of the Consolidated Appendix, the Committee incorrectly states:

> Applicant's claims contain a limitation referring to the energy states of an electron in a hitherto unheard-of and unknown form of a hydrogen atom called a "hydrino atom." The applicant has also submitted *inter alia* an attachment (number 27-Mills et al., "Excess Heat Production By the Electrolysis of an Aqueous Potassium Carbonate Electrolyte and the Implications for Cold Fusion," Fusion Technology, Vol. 20, August 1991, pp. 65-81) which shows that his theory predicts "cold fusion" as well. Since the *same theory of applicant's* that is used in the instant application to provide support for the alleged existence of the *"hydrino atom" predicts equally well irreproducible phenomena such as "cold fusion,* "the scientific basis of applicant's theory/experimental results and the *reproducibility* of the experimental results at first glance are questionable.

With no real evidence on its side with which to refute Applicant's compelling scientific evidence, the Committee, led by BMS President Souw, is left with resurrecting old arguments previously abandoned by the PTO that attempt to brand Applicant's invention with the "cold fusion" label. Contrary to the Committee's statements, Applicant's theory does NOT predict cold fusion.

Cold fusion according to Pons and Fleishmann and followers is NOT disclosed and is rejected by Applicant's theory. No fusion by compression of hydrogen isotopes in metal lattices is disclosed, supported, or claimed and the Committee knows this full well. The present application does not claim the above disclosed mechanism; thus, it is irrelevant to the present prosecution.

In the early 1990's, the PTO argued that applicant's invention was related to cold fusion. When Applicant proved it wrong, the PTO dropped the argument. In 1998, the PTO resurrected the cold fusion argument as an excuse to withdraw five of Applicant's allowed applications from issuance. However, faced with no evidence to support its position at trial, the PTO again dropped the "cold fusion" argument. Astonishingly, now eight years later, the Committee again raises the very same cold fusion arguments, with no evidence to support its position. Instead of advancing the prosecution in this case, the Committee is stuck in a time warp by cyclically resurrecting dead issues to further its "allowance is not an option" policy.

As the PTO did so many years ago, the Committee now again distorts the disclosure
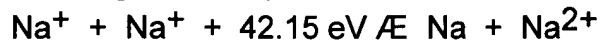
of Applicant's paper [R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991)]. Two decades ago, Applicant presented experimental data that heat was observed with the combination of a predicted catalyst and atomic hydrogen produced by electrolysis. **This data stands independently of fusion and is not claimed as fusion**. Considering the scientific integrity and capability of other independent scientists reporting that heat was involved in certain electrolysis reactions, **the authors present a case that novel chemical reactions should be considered rather than fusion as the source of the heat**. The paper reported that heat was released that was due to a chemical reaction—not a nuclear reaction. It reported that researchers studying the phenomenon of heat release in electrolytic cells should consider this as the source of heat—not fusion. From R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991):

DISCUSSION

The data clearly indicate that excess heat was generated. Once the technique was perfected, each experiment using potassium carbonate produced excess heat. Some experiments were permitted to operate for weeks, and the excess heat remained relatively constant. What is the source of this excess enthalpy? Electrochemical reactions which consume the electrolyte can be ruled out because any proposed electrochemical reactant would be completely consumed over the duration of these experiments. Nickel forms a hydride during cathodic electrolysis, but this process is endothermic [11]. The weight of the nickel cathode was unchanged by use in a heat producing cell to within one hundred thousandth of a gram (the cathode was rinsed after 36 hours of operation, and dried and degassed in vacuum before the final weight was determined). The only remaining candidates are heat releasing reactions involving the electrolytically generated hydrogen or oxygen atoms or molecules. Because the excess enthalpy exceeds that which can be accounted for due to complete recombination, new processes must be sought.

The results are consistent with the release of heat energy from hydrogen atoms where the K^+/K^+ electrocatalytic couple induces the electrons of hydrogen atoms to relax to a quantized potential energy level below that of the "ground" state by providing a redox energy-energy hole (27.28 eV) resonant with this transition. The balanced reaction is given by Equations 4.13-4.14 and Equation 4.8. Excess heat was also measured when K_2CO_3 was replaced by Rb_2CO_3 (manuscript in preparation). The Rb^+ ion (Energy hole from the second ionization is 27.28 eV) alone is

electrocatalytic according to the reaction given by Equations 4.9-4.10 and Equation 4.8. No excess heat was observed when K_2CO_3 was replaced by Na_2CO_3 as demonstrated with Na_2CO_3 #18-Na_2CO_3 #18A and Na_2CO_3 #19-Na_2CO_3 #19A shown in Figures 8 and 9, respectively. For sodium or sodium ions no electrocatalytic reaction of approximately 27.21 eV is possible. For example, 42.15 eV of energy is absorbed by the reverse of the reaction given in Equation 4.14 where Na^+ replaces K^+ :

$$Na^+ + Na^+ + 42.15\,eV \not\!\!\!{\text{Æ}} \ Na + Na^{2+}$$

The independent replication of these heat results were published [V. Noninski, Fusion Technol., Vol. 21, 163 (1992)]. Dr. Noninski of the Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER) successfully reproduced the results of Mills and Kneizys [R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991)] as a visiting professor at Franklin and Marshall College. A significant increase in temperature with every watt input, compared with the calibration experiment ($\approx 50\ ^\circ C / W$ versus $\approx 30\ ^\circ C / W$), was observed during the electrolysis of potassium carbonate. This effect was not observed when sodium carbonate was electrolyzed. No trivial explanation (in terms of chemical reactions, change in heat transfer properties, etc.) of this effect were found.

Applicant did hypothesize two decades ago that hydrino catalyzed fusion may be possible, **which is based on the experimentally proven and well accepted muon-catalyzed fusion, NOT COLD FUSION.**

The Committee's obvious confusion on this issue undercuts the rejections in this case, which therefore should be withdrawn.

Applicant further objects to the Committee's suggestion that Applicant's hypothesis somehow denigrates the experimental results of record. Applicant's experimental evidence demonstrating the existence of lower-energy hydrogen confirms Applicant's theory accurately predicted the lower energy states of hydrogen. That experimental evidence stands on its own and has absolutely <u>nothing</u> to do with cold fusion.

Additionally, in bringing up the subject of cold fusion, the Committee has raised a new standard that unwittingly invalidates quantum theory and further damages the underlying basis for its rejections. As the Committee argues, if a theory makes predictions that do not or cannot exist, i.e., "irreproducible phenomena," then "the scientific basis of [that] theory/experimental results and the reproducibility of the

experimental results at first glance are questionable." Thus, for example, outdated quantum theory for many decades predicted that the expansion of the universe was decelerating. However, modern data clearly showed that to be wrong—the universe is expanding at an accelerating rate. For this reason alone, under the Committee's own standard, all of the experimental evidence relating to quantum theory is suspect and, thus, that outdated theory cannot be used as a legitimate basis for questioning and criticizing Applicant's credible evidence. Applicant notes that his modern theory accurately predicted that the expansion of the universe was accelerating long before recent experimental evidence proved such to be the case, lending further support to the superiority of Applicant's more advanced theory and evidence.

Furthermore, outdated quantum theory is also fatally flawed since the physics of an all-space-point-particle-probability wave is nonsensical. It violates all fundamental principles including conservation of energy, momentum, causality, and is not stable to radiation. Applicant has listed numerous other examples where quantum theory has made incorrect predictions, and for the reasons stated by the Committee under its own standard, that flawed, outdated theory is questionable and certainly cannot be used as a valid excuse to ignore Applicant's compelling experimental evidence. Applicant therefore again requests that the Committee fairly consider that evidence without further delay.

On page 5 of the Consolidated Appendix, the Committee further incorrectly states:

> The examiner has rejected all the claims as not being enabled under 35 USC 112, 1st paragraph and as lacking credible utility under 35 USC 101. In addition to grounding the rejections in well-established case laws, *In re Wands,* 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988) and *Newman v. Quigg* 681 F.Supp. 16, S USPQ2d 1880, 1882 (D.D.C. 1988), the examiner set forth a *prima facie* case for the nonexistence of the "hydrino atom" by arguing and providing evidence in the attached appendices in the Office actions of record that show applicant's theory is both mathematically and scientifically flawed. Major portions of the appendices of record consolidated herein demonstrate that there is *no basis for the "hydrino atom."*

It is an embarrassment to the PTO that the Committee would rely upon the fraud

of Dr. Rathke and the biased views of BMS President Souw to allege that Applicant's modern theory has supposed mathematical flaws. It is further shocking that the Committee finds "no basis for the 'hydrino atom'" simply because it ignores or "disqualifies" the vast majority of evidence in the 65 peer-reviewed journals now of record based on flawed, outdated quantum theory that it admits is "weird" and "needs improvement." Applicant requests that the Committee stop this nonsensical approach and that it begin to consider the experimental evidence of record in a fair and expeditious manner.

On page 5 of the Consolidated Appendix, the Committee further incorrectly states:

> The existence of the "hydrino atom" defies the conventional theory of the hydrogen atom based on quantum mechanics which has been accepted by the scientific community. The applicant refers to the version of quantum mechanics accepted by the scientific community as standard quantum mechanics and refers to standard quantum mechanics using the abbreviations SQM or QM in his responses of record.

Applicant agrees that quantum theory is outdated because it cannot account for and excludes modern data, such as that provided in Applicant's 65 publications. Applicant's modern theory accurately predicted and fully accounts for these lower-energy states. Applicant continues to request that the Committee look past outdated quantum theory and fairly consider Applicant's more recent real-world data.

Outdated quantum theory is based on mathematical rules without any physical foundation. It is important to note that the Schrodinger equation (the basis for quantum theory) is NOT physical since it deals with an all space (everywhere at once) point-particle probability wave. Flawed quantum theory also does not give the correct solution of the energy levels of even the simplest atom, hydrogen. It misses spin, the electron g factor, the Lamb shift, the fine structure, the hyperfine structure, degeneracy of excited states, lack relativistic invariance, is not stable to radiation of the n=1 state, violates conservation of energy and angular momentum as well as casualty to mention just a few of the fatal flaws as pointed out in previous publications:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at

http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

Beyond the simplest atom, nothing can be solved using outdated quantum theory since the mathematics involves multi-body problems. Approximations with nonphysical assumptions and adjustable parameters are the techniques employed, wherein physics is replaced by untestable pure mathematics. Further, the mathematics associated with quantum theory is obviously internally inconsistent, since no two theoreticians use the same adjustable parameters, and, thus, that flawed theory fails to meet the Committee's own credibility standard.

This ad hoc approach is extended to molecule solutions. For example citing from Applicant's paper [R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389], in Table 9-1, McQuarrie [D. A. McQuarrie, Quantum Chemistry, University Science Books, Mill Valley, CA, (1983), pp. 343-422] presents 13 different methods for the calculation of the parameters of the hydrogen molecule. None are rigorous, physical, unique, and internally consistent, and the methods are themselves internally inconsistent and often contradictory. The number of terms in the wavefunctions span two to 100 and all involve mixing of the wavefunctions as given in Eq. (3-5) with variable parameters. Exemplary algorithms include valence bond, valence bond plus ionic terms, molecular orbital theory, molecular-orbital with configuration interaction, self consistent field method, SCF-LCAO-MO, Hartree-Fock, valence-shell electron-pair-repulsion (VSEPR) method, etc. In all of these and other such approaches, there is total disregard to conservation of energy, momentum, and radiation according to Maxwell's equations. The approaches involve an inconsistent plethora of invented wavefunctions and terms— Slater orbitals, ionic terms, molecular orbital with sigma bonds, pi bonds, delta bond, banana bonds, bonding orbitals, antibonding orbitals, (negative probability density as well as positive probability density), back-bonding orbitals (empty space), overlap, coulomb, and exchange integrals—all with intractable infinities. Ad hoc, inconsistent types of adjustable parameters such as effective nuclear charge, ionic character, correlation interactions, and arbitrary renormalization procedures to remove infinities are introduced to force the calculations to match observations.

In contrast, Applicant's modern theory is based on physical laws that exactly solve the energy levels of atoms, excited states, spin, the electron g factor, the Lamb shift, the fine structure, the hyperfine structure, degeneracy of excited states, relativistic invariance, stability to radiation of the n=1 state, and conservation of energy and angular momentum as given in the above cited references 1-10. These results are extended to give exact solutions of polyatomic molecules as given in Chps. 11, 13 and 14 of Mills GUT, an achievement that is unmatched by SQM.

A further failure of quantum theory is that the electron cloud that is everywhere at once that would give rise to a self energy that is in addition to the predicted infinities of

the Schrodinger equation "SE" and the Dirac equation "DE". This is discussed in Appendix IV of Mills GUT. Furthermore, the renormalization of quantum electrodynamics is ad hoc and fluid with terms debated for decades as discussed in Appendix II of Mills GUT. There are no infinities observed in Nature, and the prediction of such infinities cannot be mathematically waved away as argued by even Dirac. (See Appendix II of Mills GUT). Quantum theory does not predict the stability of the hydrogen atom and is not the correct model. Its many failings are discussed in detail in Mills GUT such as the following excerpt from Appendix II:

Quantum theory failed to predict the results of the Stern-Gerlach experiment, which indicated the need for an additional quantum number. Quantum electrodynamics was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. It relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors. From Weisskopf [49], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; 1.) does not explain nonradiation of bound electrons; 2.) contains an internal inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite; 3.) it admits solutions of negative rest mass and negative kinetic energy; 4.) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; 5.) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. In 1947, contrary to Dirac's predictions, Lamb discovered a $1000 \ MHz$ shift between the $^2S_{1/2}$ state and the $^2P_{1/2}$ state of the hydrogen atom [50]. This so called Lamb Shift marked the beginning of modern quantum electrodynamics. In the words of Dirac [51], "No progress was made for 20 years. Then a development came initiated by Lamb's discovery and explanation of the Lamb Shift, which fundamentally changed the character of theoretical physics. It involved setting up rules for discarding ...infinities..." Renormalization is presently believed to be required of any fundamental theory of physics [52]. However, dissatisfaction with renormalization has been

expressed at various times by many physicists including Dirac [53] who felt that, "This is just not sensible mathematics. Sensible mathematics involves neglecting a quantity when it turns out to be small—not neglecting it just because it is infinitely great and you do not want it!"

Throughout the history of quantum theory, wherever there was an advance to a new application, it was necessary to repeat a trial-and -error experimentation to find which method of calculation gave the right answers. Often the textbooks present only the successful procedure as if it followed from first principles and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle to fit the empirically successful algorithm. For example, we know that it required a great deal of art and tact over decades of effort to get correct predictions out of QED. The QED method of the determination of $(g-2)/2$ from the *postulated* Dirac equation is based on a *postulated* power series of α/π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term which is processed over decades using ad hoc rules to remove infinities from each term that arises from *postulated* scores of *postulated* Feynman diagrams. The solution so obtained using the perturbation series further requires a *postulated* truncation since the series **diverges**. Mohr and Taylor reference some of the Herculean efforts to arrive at g using QED [54]:

> "the sixth-order coefficient $A_1^{(6)}$ arises from 72 diagrams and is also known analytically after nearly 30 years of effort by many researchers [see Roskies, Remiddi, and Levine (1990) for a review of the early work]. It was not until 1996 that the last remaining distinct diagrams were calculated analytically, thereby completing the theoretical expression for $A_1^{(6)}$".

For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off the infinities) in one particular way and not in some other way that appears in principle equally valid. For example, Milonni [55] presents a QED derivation of the magnetic moment of the electron which gives a result of the wrong sign and requires the introduction of an

"upper limit K in the integration over $k = \omega/c$ in order to avoid a divergence."

A differential mass is arbitrarily added, then

"the choice $K = 0.42mc/\hbar$ yields $(g-2)/2 = \alpha/2\pi$ which is the relativistic QED result to first order in α. [...] However, the reader is warned not to take these calculations too seriously, for the result $(g-2)/2 = \alpha/2\pi$ could be obtained by retaining only the first (radiation reaction) term in (3.112) and choosing $K = 3mc/8\hbar$. It should also be noted that the solution $K \cong 0.42mc/\hbar$ of (3.112) with $(g-2)/2 = \alpha/2\pi$ is not unique."

Such an ad hoc nonphysical approach makes incredulous:

" the cliché that QED is the best theory we have!" [56]

or the statement that:

"The history of quantum electrodynamics (QED) has been one of unblemished triumph" [57].

There is a corollary, noted by Kallen: from an inconsistent theory, any result may be derived.

The QED determination of the postulated power series in α/π is based on scores of Feynman diagrams corresponding to thousands of matrices with thousands of integrations per matrix requiring decades to reach a consensus on the "appropriate" algorithm to remove the intrinsic infinities. Remarkably, $(g-2)/2$ may be derived in closed form from Maxwell's equations in a simple straightforward manner that yields a result with eleven figure agreement with experiment—the limit of experimental capability. Rather than an infinity of radically different QED models, an essential feature is that *Maxwellian solutions are unique.* The derivation from first principles without invoking virtual particles, zero point fluctuations of the vacuum, and negative energy states of the vacuum is given in the Electron g Factor section.

Furthermore, Oskar Klein pointed out a glaring paradox implied by the Dirac equation which was never resolved [58]. "Electrons may penetrate an electrostatic barrier even when their kinetic energy, $E - mc^2$ is lower than the barrier. Since in Klein's example the barrier was infinitely broad this could not be associated with wave mechanical tunnel effect. It is truly a paradox: Electrons too slow to surpass the potential, may still only be partially reflected. ...Even for an infinitely high barrier, i.e. $r_2 = 1$ and energies $\approx 1\,MeV$, (the reflection coefficient) R is less than 75%! From (2) and (3) it appears that as soon as the barrier is sufficiently high: $V > 2mc^2$, electrons may transgress the repulsive wall—seemingly defying

conservation of energy. ...Nor is it possible by way of the positive energy spectrum of the free electron to achieve complete Einstein causality."

The Rutherford experiment demonstrated that even atoms are comprised of essentially empty space [59]. Zero-point field fluctuations, virtual particles, and states of negative energy and mass invoked to describe the vacuum are nonsensical and have no basis in reality since they have never been observed experimentally and would correspond to an essentially infinite cosmological constant throughout the entire universe including regions of no mass. As given by Waldrop [60], "What makes this problem into something more than metaphysics is that the cosmological constant is observationally zero to a very high degree of accuracy. And yet, ordinary quantum field theory predicts that it ought to be enormous, about 120 orders of magnitude larger than the best observational limit. Moreover, this prediction is almost inescapable because it is a straightforward application of the uncertainty principle, which in this case states that every quantum field contains a certain, irreducible amount of energy even in empty space. Electrons, photons, quarks—the quantum field of every particle contributes. And that energy is exactly equivalent to the kind of pressure described by the cosmological constant. The cosmological constant has accordingly been an embarrassment and a frustration to every physicist who has ever grappled with it."
See also the following papers:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at

http://www.blacklightpower.com/techpapers.shtml.
7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

In contradiction to the Committee's position, Applicant's theory, which is based on classical laws, does predict precisely and exactly all of the observations recorded on the hydrogen atom including the deficiencies of the SE and DE . These include the Lamb shift (SE and DE), spin (SE), g factor (SE and DE) as well as the correct lifetimes of excited states (SE and DE), stability to radiation (DE, SE) and causality (SE, DE). The necessity of SQM to patch together inconsistent theories that are purely postulated, internally inconsistent, and incongruent with observations such as the causality of the physical world, the lack of infinities, and the absence of an infinite cosmological constant , for example, in order to explain conjugate parameters demonstrates the obvious—the only success of these equations can be attributed to the simple fact that they were postulated in order to match one aspect of Nature that was already known. It is obvious the SE for example is simply another mathematical way of writing the known Rydberg formula to which it reduces. But, these equation have no predictive capability since they are only pure mathematics with no basis in reality. They are NOT PHYSICAL and do not represent the hydrogen atom.

It is improper for the Committee to use the flawed quantum theory as an excuse to avoid considering the experimental evidence of record.

On page 5 of the Consolidated Appendix, the Committee further incorrectly

states:

> Despite applicant's repeated assertions throughout prosecution history
> that his theory proves that quantum mechanics (SQM or QM) is not valid,
> applicant has failed to displace quantum mechanics with his version of the
> theory of atomic structure for the electron energy levels of the hydrogen
> atom called classical quantum mechanics (CQM) for detailed reasons to
> be discussed in the sections herein which have already been made of
> record.

It is not Applicant's "theory" that proves that quantum mechanics is invalid and outdated, but rather the extensive experimental data of record. That state-of-the-art experimental data conclusively proves that quantum theory is wrong. As pointed out on numerous occasions by the Committee, quantum theory forbids the lower-energy states now shown to exist. Thus, outdated quantum theory must give way to Applicant's more modern theory, which fully accounts for these novel lower-energy states.

In addition, the Committee's latest standard announced above requiring that "Applicant ... displace quantum mechanics with his ... theory" is utterly ridiculous on its face. The foolishness of this standard is further shown by the Committee's own recognition that quantum theory is "weird" and "needs improvement." Given the inadequacies of that flawed theory, it hardly deserves to be held up as a benchmark as the Committee has done in this case.

On page 5 of the Consolidated Appendix, the Committee further incorrectly states:

> Contrary to applicant's assertions of record, applicant's theory of
> the hydrino atom has not been accepted by the scientific community (see
> Section 2). Unlike quantum mechanics and its predicted results for the
> hydrogen atom, applicant's theory and experimental results for the
> hydrogen atom having energy states below the conventionally accepted
> ground state are not universally accepted by the scientific community.

This standard, like so many others promoted by the Committee in this case, is erroneous and should be withdrawn for two reasons: first, the level of support (or acceptance) in the scientific community is not the proper standard for ascertaining whether an applicant has satisfied the enablement or utitlity requirements under Sections 112 and 101, respectively; and second, even under that erroneous standard, Applicant has clearly met it by showing that his claimed invention <u>does</u> have support in

the scientific community.

Regarding the Committee's misplaced reliance on its newly minted "support in the scientific community" standard to deny Applicant patent protection for his pioneering technology, that standard makes absolutely no sense and thus, not surprisingly, has no legal basis. Until recent rule changes, the PTO kept patent applications in strict confidence. Typically, an invention disclosure would be made public only after claims were found to be allowable, whereupon the application would then be published as an issued patent. So it defies common sense to claim that applicants are required to show that their inventions have support in the scientific community, when there was no requirement until recently that a patent applicant even disclose his invention to the public until such time as a patent issues.

The irony here is that, according to the Committee's nonsensical standard, the more pioneering the invention, the more difficult it will necessarily be to show "support in the scientific community." Yet these pioneering inventions are the ones most deserving of patent protection.

This requirement that Applicant show support in the scientific community was no doubt the motivation behind the Committee's demand that Applicant publish his scientific evidence of lower energy states of hydrogen in peer-reviewed journal articles. Despite the Committee's failure to cite any legal authority for that evidentiary standard, Applicant nonetheless complied with it. As previously stated, Applicant now has over 65 peer-reviewed articles published in respected scientific journals regarding the operation of his lower-energy hydrogen technology, thus demonstrating considerable support in the scientific community. Thus, by the Committee's own admission, this accomplishment establishes Applicant's satisfaction of the enablement and utility requirements under 35 U.S.C. §§ 112 and 101.

Indeed, the Committee has touted the credibility of peer-reviewed journal articles in scientific debate. Of course, that was when it was criticizing Applicant's scientific evidence of lower-energy hydrogen predicted by his theory, prior to publication of that evidence, as "not having the credibility that peer-reviewed articles have." [See, for example, page 5 of the Committee's May 19, 2004 Office Action in U.S. App'n Ser. No. 09/352,693.] Now that Applicant's evidence has been widely published in peer-

reviewed articles appearing in highly esteemed scientific journals, the Committee has the audacity to claim that his theory lacks support in the scientific community.

Consistent with its "allowance is not an option" policy, the Committee takes this extreme position even farther by claiming that Applicant's real-world evidence that lower-energy hydrogen actually exists "detract[s] from the central issue that the hydrino does not theoretically exist" and that "all of applicant's data cannot prove what is not theoretically possible." [See, for example, May 12, 2005 Advisory Action in U.S. App'n Ser. No. 09/669,877 at page 2 (emphasis added).] Thus, even when Applicant complies with the Committee's "support in the scientific community" standard by submitting scientific evidence that has been peer-reviewed by highly qualified PhD's scientists and accepted for publication in esteemed scientific journals, since, according to the Committee, that credible evidence is rejected because it supposedly "detracts" under a different patentability standard that improperly presumes his invention to be *per se* incredible.

Out of the multitude of unsupportable and conflicting patentability standards that the Committee has put forward over the years, this one truly stands out as perhaps the most outrageous. Applicant has spent enormous amounts of effort and money complying with the PTO's unlawful requirement that he publicly disclose in peer-reviewed publications confidential data generated by Applicant and independent third parties to prove the existence of lower-energy hydrogen. The only way to now settle the debate on whether lower-energy hydrogen actually exists is to properly evaluate that real-world evidence. For the Committee to now assert that those efforts were for naught since Applicant's evidence "detract[s] from the central issue that the hydrino does not theoretically exist" turns science on its head and is an embarrassment to a government agency charged with "promot[ing] the Progress of Science and useful Arts." [See U.S. Constitution, Art. I, Sect. 8, Clause 8.]

Applicant's theory absolutely has been accepted by scientists who make up the scientific community, particularly those who have actually read and considered the experimental data, now published in 65 peer-reviewed journal articles. In arguing non-acceptance of Applicant's theory by the scientific community, the Committee can only

be referring to its own members and other scientists who have refused to even read or consider that experimental evidence, or to scientists with an agenda even willing to commit fraud, such as Dr. Rathke. Applicant submits that once the Committee and other unnamed scientists referred to by the Committee actually consider his experimental evidence, they will be compelled to accept the existence of lower-energy states.

On page 5 of the Consolidated Appendix, the Committee further incorrectly states:

> To date, applicant's theory of the hydrino atom which applicant has publicized as least as early as 1989 is not taught in standard science textbooks used in universities worldwide in contrast to standard quantum mechanics (SQM or QM).

Applicant is unaware of any law that requires teaching of an invention as a prerequisite for patentability. Furthermore, universities at one time in history also taught the world was flat, among other wrong theories. In a similar fashion, outdated quantum theory, with its fantasy world of multiple dimensions and other weird anomalies is now being supplanted with Applicant's modern theory, which more accurately represents the real world we live in.

On pages 5-6 of the Consolidated Appendix, the Committee further incorrectly states:

> In addition, the energy levels having fractional quantum numbers $n = 1/2$, $1/3$, $1/4...$, are not recognized in the National Institute of Standard and Technology's (NIST's) database for the energy levels of the hydrogen atom whereas energy levels having integer values of n 1, 2, 3..., as predicted by standard quantum mechanics, are listed in NIST's database (see Section 2).

These statements are truly incredible. For over a decade, NIST has had an open invitation to test Applicant's lower-energy technology, but has refused to conduct such tests. In light of that refusal, it is no surprise that Applicant's data cannot be found on NIST's website. It is absurd for the Committee to now suggest that NIST would place data on its website for experiments that it did not conduct. The fact that NIST makes no comment on lower-energy hydrogen is totally irrelevant and that the Committee would even bring the matter up says more about the weakness of its own position than it does

about Applicant's.

On page 7 of the Consolidated Appendix, the Committee further incorrectly states:

> A review and analysis of the main mathematical underpinnings in GUT shows that there is no proper theoretical basis for applicant to assert the existence of the hydrino atom (see Sections 3-10). Nowhere in prosecution history has Mills satisfactorily established that fractional values of n arise as a natural consequence of a logical and internally consistent mathematical and scientific framework. While GUT bristles with a dense array of mathematical equations, the fractional values of n are not shown to be the unequivocal end result of Mills's theory.

These mere conclusions by the Committee are not evidence and have no weight. Applicant has shown with great detail how his modern theory is based Maxwell's equations and with closed form equations predicts the existence of lower energy states. Applicant then conclusively proved the existence of these lower energy states by the 65 publications now of record, which stand unrefuted by the Committee.

From first principles, Applicant's modern theory predicts the masses of the proton and neutron and their magnetic moments to within a part per hundred thousand of the observed values in closed form equations containing fundamental constants only.[1] The Committee has not refuted this evidence.

On page 7 of the Consolidated Appendix, the Committee further incorrectly states:

> The mathematical analysis of applicant's theory (see Sections 9 and 10) shows that there is an internal break in the logic of applicant's theory, with applicant (Mills) ultimately relying on conclusionary statements, such as, a nonradiative boundary condition and the relationship between the electron and a photons give transitions in which the electron goes to a "lower" energy nonradiative state with a smaller radius or alternatively, that an electron can undergo a collision with an "energy hole" which allows the electron to undergo a transition to a lower energy nonradiative state with a smaller radius (see pages 16-17 of GUT (1999 edition)).

Applicant has provided a detailed Response that demonstrates Applicant's theory is not *ad hoc*, but based on classical laws using closed form equations, which the

[1] Reference 39 at Proton and Neutron section.

Committee simply ignores in favor of its own biased views expressed by Dr. Souw whose commercial interests are in conflict with those of Applicant. Once again, the radial Dirac delta function corresponds to the two-dimensional wave equation plus time. This wave equation gives the correct physics of constant energy and angular momentum and provides for the stability of the bound electron to radiation in accordance with Maxwell's equations. See, for example:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, submitted.

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

As given in many instances, such as the Introduction of Mills GUT (Ref. #1):

CQM APPROACH TO THE SOLUTION OF THE ELECTRON

CQM solves the electron by a different approach than that used to solve the Schrödinger wave equation. Rather than using a postulated wave equation with time eliminated in terms of the energy of the electron in a Coulomb field and solving the charge wave (Schrödinger interpretation) or the probability wave (Born interpretation), the solution for

the scalar (charge) and vector potential (current) functions of the electron are sought based on first principles. CQM first assumes that the functions that physically describe the mass and charge of the electron in space and time obey the wave equation since it conserves energy and angular momentum. The solution is initially generalized to be three dimensional plus time. Rather than use the postulated Schrödinger boundary condition: "$\Psi \rightarrow 0$ as $r \rightarrow \infty$", which leads to a purely mathematical model of the electron, the constraint is based on the experimental observation that the moving charge must not radiate. Application of the Haus' condition based on Maxwell's equations to a generalized three dimension plus time wave equation requires that the functions must be solutions of Eq. (I.16), a two dimensional wave equation plus time. This is consistent with first principle laws and ultimately matches experimentation. However, it is unconventional.

The two dimensional wave equation plus time is given by McQuarrie [2]. It is mathematically identical to the familiar rigid rotor equation of QM. The electron is confined to two dimensions (θ and ϕ) plus time, and the corresponding wave equation solution is called an electron orbitsphere. Spherical harmonic functions and time harmonic functions are well known solutions of the angular and time components of the two dimensional wave equation plus time, respectively. The solutions appear in McQuarrie [3]. A constant current function is also a solution of the wave equation. A constant function corresponding to the electron spin function is added to each of the spherical harmonic functions to give the charge (mass)-density functions of the electron as a function of time. The integral of a spherical harmonic function over the orbitsphere is zero. The integral of the constant function over the orbitsphere is the total charge (mass) of the electron. These functions comprise the well known s, p, d, f, etc. electrons or orbitals. In the case that such an electron state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current-density function since it possesses spacetime Fourier components synchronous with waves traveling at the speed of light as shown in the Instability of the Excited States section.

The excited states are solved including the radii of the orbitspheres using Maxwell's equations with the traditional source current boundary constraints at the electron. Quantization arises from the equation of the photon and the electron—not from the solution of the electron alone. After all, each solution models an excited state created by the absorption of a photon. The solutions are analogous to those of excited resonator modes except that the cavity is dynamic. The field lines from the proton end on the current-density function of the electron, and the electric field is zero for $r > r_n$. The trapped photons are a solution of the three dimensional wave equation plus time given by Maxwell's equations. The electrodynamic field

of the photon is a constant function plus a time and spherical harmonic function that is in phase with source currents at the electron which is given by a constant plus a time and spherical harmonic function. Only particular solutions are possible as resonant photons of the electron which is a dynamic resonator cavity. The results are in agreement with first principle physics and experimental observations of the hydrogen atom, excited states, free electron, and free space photon including the wave particle duality aspects.

SPIN AND ORBITAL PARAMETERS ARISE FROM FIRST PRINCIPLES

An electron is a spinning, two-dimensional spherical surface, called an *electron orbitsphere*, that can exist in a bound state only at specific radii r_n from the nucleus. (See Figure 1.1 for a pictorial representation of an orbitsphere.) The result for the $n = 1$ state of hydrogen is that the charge-density function remains constant with each point on the surface moving at the same angular and linear velocity. The constant function solution of the two dimensional wave equation corresponds to the spin function which has a corresponding spin angular momentum that may be calculated from $\mathbf{r} \times \mathbf{p}$ applied directly to the current-density function that describes the electron. The radius of the nonradiative ($n = 1$) state is solved using the electromagnetic force equations of Maxwell relating the charge and mass-density functions wherein the angular momentum of the electron is $\hbar$ (Eq. (1.165)). The reduced mass arises naturally from an electrodynamic interaction between the electron and the proton rather than from a point mass revolving around a point nucleus in the case of Schrödinger wave equation solutions which presents an internal inconsistency since the wave functions are spherically symmetrical.

CQM gives closed form solutions for the resonant photons and excited state electron functions. The free space photon also comprises a radial Dirac delta function, and the angular momentum of the photon given by $\mathbf{m} = \int \frac{1}{8\pi c} \mathrm{Re}[\mathbf{r} \times (\mathbf{E} \times \mathbf{B}^*)] dx^4 = \hbar$ in the Photon section is conserved for the solutions for the resonant photons and excited state electron functions. It can be demonstrated that the resonance condition between these frequencies is to be satisfied in order to have a net change of the energy field [4]. In the present case, the correspondence principle holds. That is the change in angular frequency of the electron is equal to the angular frequency of the resonant photon that excites the resonator cavity mode corresponding to the transition, and the energy is given by Planck's equation. The predicted energies, Lamb shift, fine structure splitting, hyperfine structure, resonant line shape, line width, selection rules, etc. are in agreement with observation.

The radii of excited states are solved using the electromagnetic force equations of Maxwell relating the field from the charge of the proton, the electric field of the photon, and charge and mass-density functions of the electron wherein the angular momentum of the electron is $\hbar$ (Eq. (1.165)).

For excited states of the hydrogen atom, the constant function solution of the two dimensional wave equation corresponds to the spin function. Each spherical harmonic function modulates the constant spin function and corresponds to an orbital function of a specific excited state with a corresponding phase-matched trapped photon and orbital angular momentum. Thus, the spherical harmonic function behaves as a charge-density wave which travels time harmonically on the surface of the orbitsphere about a specific axis. (See Figure 1.2 for a pictorial representation.) The amplitude of the corresponding orbital energy may be calculated from Maxwell's equations. Since the constant function is modulated harmonically, the time average of the orbital energy is zero except in the presence of a magnetic field. Nondegeneracy of energy levels arises from spin, orbital, and spin-orbital coupling interactions with the applied field. The electrodynamic interaction with the magnetic field gives rise to the observed hyperfine splitting of the hydrogen spectrum.

Many inconsistencies arise in the case of the corresponding solutions of the Schrödinger wave equation. For example, where is the photon in excited states given by the Schrödinger equation? And, a paradox arises for the change in angular momentum due to photon absorption. The Schrödinger equation solutions for the kinetic energy of rotation K_{rot} is given by Eq. (10) of ref. [5] and the value of the electron angular momentum L for the state $Y_{lm}(\theta,\phi)$ is given by Eq. (11) of ref. [5]. They predict that the excited state rotational energy levels are nondegenerate as a function of the ℓ quantum number even in the absence of an applied magnetic field, and the predicted energy is over six orders of magnitude of the observed nondegenerate energy in the presence of a magnetic field. In the absence of a magnetic field, no preferred direction exists. In this case, the ℓ quantum number is a function of the orientation of the atom with respect to an arbitrary coordinate system. Therefore, the nondegeneracy is nonsensical and violates conservation of angular momentum of the photon.

In quantum mechanics, the spin angular momentum of the electron is called the "intrinsic angular momentum" since no physical interpretation exists. The Schrödinger equation is not Lorentzian invariant in violation of special relativity. It fails to predict the results of the Stern-Gerlach experiment which indicates the need for an additional quantum number. Quantum Electrodynamics (QED) was proposed by Dirac in 1926 to

provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. It is fatally flawed. From Weisskopf [6], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; 1.) DOES NOT EXPLAIN NONRADIATION OF BOUND ELECTRONS; 2.) contains an internal inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite (the Schrödinger equation fails to predict the classical electron radius); 3.) it admits solutions of negative rest mass and negative kinetic energy; 4.) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; 5.) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. Dirac's equation which was postulated to explain spin relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors. All of these features are untenable or are inconsistent with observation. These problems regarding spin and orbital angular momentum and energies and the classical electron radius are nonexistent with CQM solutions.

Furthermore, the mathematical relationship whereby the Schrödinger equation may be transformed into a form consistent with first principles is shown *infra*. In the case that the potential energy of the Hamiltonian, H, is a constant times the wavenumber, the Schrödinger equation is the well known Bessel equation. Then one of the solutions for the wavefunction Ψ (a current-density function rather than a probability wave) is equivalent to an inverse Fourier transform. According to the duality and scale change properties of Fourier transforms, the energy equation of CQM and that of quantum mechanics are identical, the energy of a radial Dirac delta function of radius equal to an integer multiple of the radius of the hydrogen atom.

CLASSICAL QUANTUM THEORY

One-electron atoms include the hydrogen atom, He^+, Li^{2+}, Be^{3+}, and so on. The mass-energy and angular momentum of the electron are constant; this requires that the equation of motion of the electron be temporally and spatially harmonic. Thus, the classical wave equation applies and

$$\left[\nabla^2 - \frac{1}{v^2} \frac{\partial^2}{\partial t^2} \right] \rho(r, \theta, \phi, t) = 0 \qquad (1.2)$$

where $\rho(r, \theta, \phi, t)$ is the charge-density function of the electron in time and space. In general, the wave equation has an infinite number of solutions.

To arrive at the solution which represents the electron, a suitable boundary condition must be imposed. It is well known from experiments that each single atomic electron of a given isotope radiates to the same stable state. Thus, CQM uses the physical boundary condition of nonradiation of the bound electron to be imposed on the solution of the wave equation for the charge-density function of the electron. The condition for radiation by a moving point charge given by Haus [7] is that its spacetime Fourier transform possesses components that are synchronous with waves traveling at the speed of light. Conversely, it is proposed that the condition for nonradiation by an ensemble of moving point charges that comprises a charge-density function is

For non-radiative states, the current-density function must NOT possess spacetime Fourier components that are synchronous with waves traveling at the speed of light.

The Haus derivation applies to a moving charge-density function as well because charge obeys superposition. The Haus derivation is summarized below.

The Fourier components of the current produced by the moving charge are derived. The electric field is found from the vector equation in Fourier space ($\mathbf{k}$, ω-space). The inverse Fourier transform is carried over the magnitude of $\mathbf{k}$. The resulting expression demonstrates that the radiation field is proportional to $\mathbf{J}_\perp(\frac{\omega}{c}\mathbf{n}, \omega)$, where $\mathbf{J}_\perp(\mathbf{k}, \omega)$ is the spacetime Fourier transform of the current perpendicular to $\mathbf{k}$ and $\mathbf{n} \equiv \frac{\mathbf{k}}{|k|}$. Specifically,

$$\mathbf{E}_\perp(\mathbf{r}, \omega)\frac{d\omega}{2\pi} = \frac{c}{2\pi}\int\rho(\omega,\Omega)d\omega d\Omega\sqrt{\frac{\mu_0}{\varepsilon_0}}\mathbf{n}\,X\left(\mathbf{n}\,X\,\mathbf{J}_\perp\left(\frac{\omega}{c}\mathbf{n}, \omega\right)e^{i\left(\frac{\omega}{c}\right)\mathbf{n} \cdot \mathbf{r}}\right) \quad (1.3)$$

The field $\mathbf{E}_\perp(\mathbf{r}, \omega)\frac{d\omega}{2\pi}$ is proportional to $\mathbf{J}_\perp\left(\frac{\omega}{c}\mathbf{n}, \omega\right)$, namely, the Fourier component for which $\mathbf{k} = \frac{\omega}{c}$. Factors of ω that multiply the Fourier component of the current are due to the density of modes per unit volume and unit solid angle. An unaccelerated charge does not radiate in free space, not because it experiences no acceleration, but because it has no Fourier component $\mathbf{J}_\perp\left(\frac{\omega}{c}\mathbf{n}, \omega\right)$. (Nonradiation is also shown directly using Maxwell's equations in Appendix I: Nonradiation Based on the Electromagnetic Fields and the Poynting Power Vector.)

The time, radial, and angular solutions of the wave equation are

separable. The motion is time harmonic with frequency ω_n. To be a harmonic solution of the wave equation in spherical coordinates, the angular functions must be spherical harmonic functions. A zero of the spacetime Fourier transform of the product function of two spherical harmonic angular functions, a time harmonic function, and an unknown radial function is sought. The solution for the radial function which satisfies the boundary condition is a delta function

$$f(r) = \frac{1}{r^2}\delta(r - r_n) \tag{I.4}$$

where $r_n = nr_1$ is an allowed radius. Thus, bound electrons are described by a charge-density (mass-density) function which is the product of a radial delta function ($f(r) = \frac{1}{r^2}\delta(r - r_n)$), two angular functions (spherical harmonic functions), and a time harmonic function. Thus, an electron is a spinning, two-dimensional spherical surface, called an *electron orbitsphere*, that can exist in a bound state at only specified distances from the nucleus as shown in Figure 1.1. More explicitly, the orbitsphere comprises a two-dimensional spherical shell of moving charge.

The total function that describes the spinning motion of each electron orbitsphere is composed of two functions. One function, the spin function, is spatially uniform over the orbitsphere, spins with a quantized angular velocity, and gives rise to spin angular momentum. The other function, the modulation function, can be spatially uniform—in which case there is no orbital angular momentum and the magnetic moment of the electron orbitsphere is one Bohr magneton—or not spatially uniform—in which case there is orbital angular momentum. The modulation function also rotates with a quantized angular velocity.

The uniform current density function $Y_0^0(\phi, \theta)$, the orbitsphere equation of motion of the electron (Eqs. (1.64-1.65)), corresponding to the constant charge function of the orbitsphere that gives rise to the spin of the electron is generated from a basis set current-vector field defined as the orbitsphere current-vector field ("orbitsphere-cvf"). This in turn is generated from orthogonal great circle current loops that serve as basis elements. In Appendix III, the *continuous* uniform electron current density function $Y_0^0(\phi, \theta)$ (Eqs. (1.64-1.65)) is then exactly generated from this orbitsphere-cvf as a basis element by a convolution operator comprising an autocorrelation-type function.

The orbitsphere-cvf comprises an infinite series of correlated orthogonal great circle current loops. The current pattern is generated over the surface by two sets of an infinite series of nested rotations of two orthogonal great circle current loops where the coordinate axes rotate with the two orthogonal great circles. Each infinitesimal rotation of the infinite series is about the new i'-axis and new j'-axis which results from the

preceding such rotation. For each of the two sets of nested rotations, the angular sum of the rotations about each rotating i'-axis and j'-axis totals $\frac{\sqrt{2}}{2}\pi$ radians.

Consider the electron to be evenly distributed within two sets of orthogonal great circle current loops for Steps One and Two. Then, consider two infinitesimal point mass (charge)-density elements, one and two, of one set of two orthogonal great circle current loops wherein initially the first current loop lies in the yz-plane, and the second current loop lies in the xz-plane. The xyz Cartesian coordinate frame is designated the laboratory reference frame. The algorithm to generate the orbitsphere-cvf rotates the great circles and the corresponding coordinates relative to the xyz frame. A primed Cartesian coordinate system refers to the axes that rotate with the great circles and determines the basis-set reference frame. Each element of the current pattern is obtained with each conjugate set of rotations. For Step One, consider two such infinitesimal charges (masses) at points one (moving counter clockwise on the great circle in the y'z'-plane) and two (moving clockwise on the great circle in the x'z'-plane) of two orthogonal great circle current loops in the basis frame are considered as sub-basis elements to generate the current density corresponding to the spin quantum number, $s = \frac{1}{2}$; $m_s = \pm\frac{1}{2}$. Initially element one is at $x' = 0$, $y' = 0$, and $z' = r_n$ and element two is at $x' = r_n$, $y' = 0$, and $z' = 0$ as shown in Figure 1.4A. The equations of motion, in the sub-basis-set reference frame are given by

point one:

$$x_1^{'} = 0 \qquad y_1^{'} = -r_n\sin(\omega_n t) \qquad z_1^{'} = r_n\cos(\omega_n t) \qquad \text{(I.5a)}$$

point two:

$$x_2^{'} = r_n\cos(\omega_n t) \qquad y_2^{'} = 0 \qquad z_2^{'} = r_n\sin(\omega_n t) \qquad \text{(I.5b)}$$

For Step Two, consider two charge (mass)-density elements, point one and two, in the basis-set reference frame at time zero. Element one is at $x' = 0$, $y' = r_n$, and $z' = 0$ and element two is at $x' = r_n$, $y' = 0$, and $z' = 0$. Let element one move clockwise on a great circle toward the -z'-axis as shown in Figure 1.4B, and let element two move counter clockwise on a great circle toward the y'-axis as shown in Figure 1.4B. The equations of motion, in the basis-set reference frame are given by

point one:

$$x_1' = 0 \qquad\qquad y_1' = r_n \cos(\omega_n t) \qquad\qquad z_1' = -r_n \sin(\omega_n t) \qquad (I.6a)$$

point two:

$$x_2' = r_n \cos(\omega_n t) \qquad y_2' = r_n \sin(\omega_n t) \qquad\qquad\qquad z_2' = 0 \qquad (I.6b)$$

The great circles are rotated by an infinitesimal angle $\pm\Delta\alpha_i$ (a rotation around the x'-axis or z'-axis for Steps One and Two, respectively) and then by $\pm\Delta\alpha_j$ (a rotation around the new y'-axis or x'-axis for Steps One and Two, respectively) where the rotation directions are shown in Figures 1.4A and 1.4B, respectively. The coordinates of each point on each rotated great circle (x',y',z') is expressed in terms of the first (x,y,z) coordinates by the following transforms where clockwise rotations are defined as positive:

Step One

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & 0 & -\sin(\Delta\alpha_y) \\ 0 & 1 & 0 \\ \sin(\Delta\alpha_y) & 0 & \cos(\Delta\alpha_y) \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & \sin(\Delta\alpha_y)\sin(\Delta\alpha_x) & -\sin(\Delta\alpha_y)\cos(\Delta\alpha_x) \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_y) & -\cos(\Delta\alpha_y)\sin(\Delta\alpha_x) & \cos(\Delta\alpha_y)\cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$(I.7)$$

Step Two

$$
\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\sin(\Delta\alpha_z) & \cos(\Delta\alpha_z) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}
$$

$$
\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\cos(\Delta\alpha_x)\sin(\Delta\alpha_z) & \cos(\Delta\alpha_x)\cos(\Delta\alpha_z) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_x)\sin(\Delta\alpha_z) & -\sin(\Delta\alpha_x)\cos(\Delta\alpha_z) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}
$$

(I.8)

where the angular sum is $\displaystyle \lim_{\Delta\alpha \to 0} \sum_{n=1}^{\frac{\frac{\sqrt{2}}{2}\pi}{|\Delta\alpha_{i,j}|}} |\Delta\alpha_{i,j}| = \frac{\sqrt{2}}{2}\pi$.

The orbitsphere-cvf is given by n reiterations of Eqs. (I.7) and (I.8) for each point on each of the two orthogonal great circles during each of Steps One and Two where the sign of $\pm\Delta\alpha_i$ and $\pm\Delta\alpha_j$ for each Step are given in Table 1.1. The output given by the non-primed coordinates is the input of the next iteration corresponding to each successive nested rotation by the infinitesimal angle $\pm\Delta\alpha_i$ or $\pm\Delta\alpha_j$ where the magnitude of the angular sum of the n rotations about each of the i'-axis and the j'-axis is $\frac{\sqrt{2}}{2}\pi$. Half of the orbitsphere-cvf is generated during each of Steps One and Two.

Following Step Two, in order to match the boundary condition that the magnitude of the velocity at any given point on the surface is given by Eq. (1.56), the output half of the orbitsphere-cvf is rotated clockwise by an angle of $\frac{\pi}{4}$ about the z-axis. Using Eq. (I.8) with $\Delta\alpha_z = \frac{\pi}{4}$ and $\Delta\alpha_x = 0$ gives the rotation. Then, the one half of the orbitsphere-cvf generated from Step One is superimposed with the complementary half obtained from Step Two following its rotation about the z-axis of $\frac{\pi}{4}$ to give the orbitsphere-cvf.

The current pattern of the orbitsphere-cvf generated by the nested rotations of the orthogonal great circle current loops is a continuous and total coverage of the spherical surface, but it is shown as visual

representations using 6 degree increments of the infinitesimal angular variable $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ of Eqs. (I.7) and (I.8) from six perspectives in Figures 1.5A-F. In each case, the complete orbitsphere-cvf current pattern corresponds to all the correlated points, points one and two, of the orthogonal great circles shown in Figures 1.4A and 1.4B which are rotated according to Eqs. (I.7) and (I.8) where $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ approach zero and the summation of the infinitesimal angular rotations of $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ about the successive i'-axes and j'-axes is $\dfrac{\sqrt{2}}{2}\pi$ for each Step. The current pattern gives rise to the phenomenon corresponding to the spin quantum number.

The resultant angular momentum projections of $L_{xy} = \dfrac{\hbar}{4}$ and $L_z = \dfrac{\hbar}{2}$ meet the boundary condition for the unique current having an angular velocity magnitude at each point on the surface given by Eq. (1.56) and give rise to the Stern Gerlach experiment as shown in the Magnetic Parameters of the Electron (Bohr Magneton) section, and in the Electron g Factor section. The further constraint that the current density is uniform such that the charge density is uniform, corresponding to an equipotential, minimum energy surface is satisfied by using the orbitsphere-cvf as a basis element to generate $Y_0^0(\phi,\theta)$ using a convolution operator comprising an autocorrelation-type function as given in Appendix III. The operator comprises the convolution of each great circle current loop of the orbitsphere-cvf designated as the primary orbitsphere-cvf with a second orbitsphere-cvf designated as the secondary orbitsphere-cvf.

The orbitsphere-cvf comprises two components corresponding to each of STEP ONE and STEP TWO. As shown for STEP TWO, the angular momentum vector is stationary on the $\left(-\dfrac{1}{\sqrt{2}}\,i_x, \dfrac{1}{\sqrt{2}}\,i_y, i_z\right)$-axis as the component orbitsphere-cvf is generated by the series of nested rotations using Eq. (1.70b). It is shown in Appendix III that STEP TWO can also be generated by a 2π-rotation of a single basis-element current loop about the $\left(-\dfrac{1}{\sqrt{2}}\,i_x, \dfrac{1}{\sqrt{2}}\,i_y, i_z\right)$-axis. In the general case that the resultant angular momentum of each pair of orthogonal great circle current loops of the component orbitsphere-cvf is along the 2π-rotational axis (defined as the rotational axis which generates the component orbitsphere-cvf from a basis-element great circle), a secondary nth component orbitsphere-cvf can serve as a basis element to match the angular momentum of any given nth great circle of a primary component orbitsphere-cvf. The replacement of each great circle of the primary orbitsphere-cvf with a secondary orbitsphere-cvf of matching angular momentum, orientation,

and phase comprises an autocorrelation-type function that exactly gives rise to the spherically-symmetric current density, $Y_0^{\,0}(\phi,\theta)$, as the sum of two uniform spherical contributions from each component. The resulting exact uniform current distribution obtained from the convolution has the same angular momentum distribution, resultant, $\mathbf{L_R}$, and components of $\mathbf{L}_{xy} = \dfrac{\hbar}{4}$ and $\mathbf{L}_z = \dfrac{\hbar}{2}$ as those of the orbitsphere-cvf used as a primary basis element.

In contrast to the QM and QED cases (See Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality), the fourth quantum number arises naturally in CQM as derived in the Electron g Factor section. The Stern-Gerlach experiment implies a magnetic moment of one Bohr magneton and an associated angular momentum quantum number of 1/2. Historically, this quantum number is called the spin quantum number, s ($s = \dfrac{1}{2}$; $m_s = \pm\dfrac{1}{2}$). Conservation of angular momentum of the orbitsphere permits a discrete change of its "kinetic angular momentum" ($\mathbf{r} \times m\mathbf{v}$) with respect to the field of $\dfrac{\hbar}{2}$, and concomitantly the "potential angular momentum" ($\mathbf{r} \times e\mathbf{A}$) must change by $-\dfrac{\hbar}{2}$. The flux change, ϕ, of the orbitsphere for $r < r_n$ is determined as follows:

$$\Delta\mathbf{L} = \frac{\hbar}{2} - \mathbf{r} \times e\mathbf{A} \tag{I.9}$$

$$= \left[\frac{\hbar}{2} - \frac{e2\pi rA}{2\pi}\right]\hat{z} \tag{I.10}$$

$$= \left[\frac{\hbar}{2} - \frac{e\phi}{2\pi}\right]\hat{z} \tag{I.11}$$

In order that the change of angular momentum, $\Delta\mathbf{L}$, equals zero, ϕ must be $\Phi_0 = \dfrac{h}{2e}$, the magnetic flux quantum. Thus, to conserve angular momentum in the presence of an applied magnetic field, the orbitsphere magnetic moment can be parallel or antiparallel to an applied field as observed with the Stern-Gerlach experiment, and the flip between orientations is accompanied by the "capture" of the magnetic flux quantum by the orbitsphere. During the spin-flip transition, power must be conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \bullet (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o\mathbf{H} \bullet \mathbf{H}\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o\mathbf{E} \bullet \mathbf{E}\right] - \mathbf{J} \bullet \mathbf{E} \tag{I.12}$$

Eq. (I.13) derived in the Electron g Factor section gives the total energy of the flip transition which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric

energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively.

$$\Delta E_{mag}^{spin} = 2\left(1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2\right)\mu_B B \qquad (I.13)$$

$$\Delta E_{mag}^{spin} = g\mu_B B \qquad (I.14)$$

The spin-flip transition can be considered as involving a magnetic moment of g times that of a Bohr magneton. The g factor is redesignated the fluxon g factor as opposed to the anomalous g factor. The calculated value of $\frac{g}{2}$ is 1.001 159 652 137. The experimental value [8] of $\frac{g}{2}$ is 1.001 159 652 188(4).

CQM solves the wave equation for the charge-density function of the electron. The time, radial, and angular solutions of the wave equation are separable. Also, the radial function for the electron indicates that the electron is two-dimensional. Therefore, the angular mass-density function of the electron, $A(\theta, \phi, t)$, must be a solution of the wave equation in two dimensions (plus time). EQ. (I.2) becomes

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]A(\theta, \phi, t) = 0 \qquad (I.15)$$

where $\rho(r, \theta, \phi, t) = f(r)A(\theta, \phi, t) = \frac{1}{r^2}\delta(r - r_n)A(\theta, \phi, t)$ and

$A(\theta, \phi, t) = Y(\theta, \phi)k(t)$. Specifically, the wave equation is

$$\left[\frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial}{\partial\theta}\right)_{r,\phi} + \frac{1}{r^2\sin^2\theta}\left(\frac{\partial^2}{\partial\phi^2}\right)_{r,\theta} - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]A(\theta, \phi, t) = 0 \qquad (I.16)$$

where v is the linear velocity of the electron. The charge-density functions including the time-function factor are

$\ell = 0$

$$\rho(r, \theta, \phi, t) = \frac{e}{8\pi r^2}[\delta(r - r_n)]\left[Y_0^0(\theta, \phi) + Y_\ell^m(\theta, \phi)\right] \qquad (I.17)$$

$\ell \neq 0$

$$\rho(r, \theta, \phi, t) = \frac{e}{4\pi r^2}[\delta(r - r_n)]\left[Y_0^0(\theta, \phi) + \mathrm{Re}\left\{Y_\ell^m(\theta, \phi)e^{i\omega_n t}\right\}\right] \qquad (I.18)$$

where $\mathrm{Re}\left\{Y_\ell^m(\theta, \phi)e^{i\omega_n t}\right\} = P_\ell^m(\cos\theta)\cos(m\phi + \omega_n' t)$ and to keep the form of the spherical harmonic as a traveling wave about the z-axis, $\omega_n' = m\omega_n$.

The spin function of the electron (see Figure 1.1 for the charge function and Figure 1.5A for the current function) corresponds to the nonradiative $n = 1$, $\ell = 0$ state of atomic hydrogen which is well known as an s state or orbital. The constant spin function is modulated by a time

and spherical harmonic function as given by Eq. (I.18) and shown in Figure 1.2. The modulation or traveling charge-density wave corresponds to an orbital angular momentum in addition to a spin angular momentum. These states are typically referred to as p, d, f, etc. orbitals and correspond to an ℓ quantum number not equal to zero. Application of the condition from Haus [7] (Eqs, (I.19-I.21)) also predicts nonradiation for a constant spin function modulated by a time and spherically harmonic orbital function. There is acceleration without radiation. (Also see Abbott and Griffiths and Goedecke [9-10]). Nonradiation is also shown directly using Maxwell's equations in Appendix I: Nonradiation Based on the Electromagnetic Fields and the Poynting Power Vector. However, in the case that such a state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current-density function since it possesses spacetime Fourier transform components synchronous with waves traveling at the speed of light as shown in the Instability of Excited States section.

The Fourier transform of the electron charge-density function is a solution of the four-dimensional wave equation in frequency space (**k**, ω-space). Then the corresponding Fourier transform of the current-density function $K(s,\Theta,\Phi,\omega)$ is given by multiplying by the constant angular frequency.

$$K(s,\Theta,\Phi,\omega) = 4\pi\omega_n \frac{\sin(2s_n r_n)}{2s_n r_n} \otimes 2\pi\sum_{v=1}^{\infty} \frac{(-1)^{v-1}(\pi\sin\Theta)^{2(v-1)}}{(v-1)!(v-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(v+\frac{1}{2}\right)}{(\pi\cos\Theta)^{2v+1}2^{v+1}} \frac{2v!}{(v-1)!} s^{-2v}$$

$$\otimes 2\pi\sum_{v=1}^{\infty} \frac{(-1)^{v-1}(\pi\sin\Phi)^{2(v-1)}}{(v-1)!(v-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(v+\frac{1}{2}\right)}{(\pi\cos\Phi)^{2v+1}2^{v+1}} \frac{2v!}{(v-1)!} s^{-2v} \frac{1}{4\pi}[\delta(\omega-\omega_n)+\delta(\omega+\omega_n)]$$

(I.19)

The motion on the orbitsphere is angular; however, a radial component exists due to special relativistic effects. Consider the radial wave vector of the sinc function. When the radial projection of the velocity is c

$$\mathbf{s}_n \bullet \mathbf{v}_n = \mathbf{s}_n \bullet \mathbf{c} = \omega_n$$

(I.20)

the relativistically corrected wavelength is

$$r_n = \lambda_n$$

(I.21)

(i.e. the lab frame motion in the angular direction goes to zero as the velocity approaches the speed of light). Substitution of Eq. (I.21) into the sinc function results in the vanishing of the entire Fourier transform of the current-density function. Thus, spacetime harmonics of $\dfrac{\omega_n}{c} = k$ or

$\dfrac{\omega_n}{c}\sqrt{\dfrac{\varepsilon}{\varepsilon_o}} = k$ for which the Fourier transform of the current-density function

is nonzero do not exist. Radiation due to charge motion does not occur in any medium when this boundary condition is met.

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10. G. Goedecke, Phys. Rev 135B, (1964), p. 281.

11. Fowles, G. R., Analytical Mechanics, Third Edition, Holt, Rinehart, and Winston, New York, (1977), pp. 154-156.

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This evidence stands unrebutted by the Committee.

On pages 7-8 of the Consolidated Appendix, the Committee further incorrectly states:

> By way of background, there are at least two conventionally recognized approaches to the problem of obtaining the energy levels of the electron in the hydrogen atom in standard quantum mechanics (SQM or QM as referred to by applicant). These are:
>
> (a) *Via* a Differential Equation approach formulated as a two-point boundary value problem where boundary conditions at the nucleus and at infinity are imposed on the radial wavefunction of the electron which

satisfies a second-order linear differential equation known as Schrodinger's wave equation which is typically taught in undergraduate physical chemistry. It is to be understood that while the complete wavefunction in spherical polar coordinates is the product of a radial wavefunction and angular wavefunctions, the complete wavefunction for the ground (or lowest energy) state of the hydrogen atom is independent of angular coordinates in view of the spherical symmetry of that state, and is studied only on the basis of the radial wavefunction. Thus, see sections 18d-18e and 21b at pages 121-124 and 139 from Pauling and Wilson's Introduction to Quantum Mechanics (Dover Publications, Inc., New York, 1985) and **Endnote 1**.

(b) *Via* an Integral Equation approach wherein the boundary conditions on the radial wavefunction of the electron are "built into" the integral equation itself rather than being imposed on it as in the differential equation formulation. In this approach, upon taking the Fourier transform of the wavefunction, subject to the boundary condition that it satisfies Schrodinger's equation, an integral equation is obtained. Thus, see pages 899-900 from Morse and Feshbach's Methods of Theoretical Physics, Part I (McGraw-Hill Book Company, New York, 1953) and Endnote 2.

It is crucial to note that either approach is but a mathematical tool and that, while the integral equation approach may be mathematically more compact, and perhaps, be more convenient for solving certain problems compared to the differential equation approach, the final results given by either approach must not be mutually contradictory if a scientific theory based on these approaches is to be logical and internally consistent.

Outdated quantum theory is based on mathematical rules without any physical foundation. With regard to the Committee's statement that "[i]t is crucial to note that either approach is but a mathematical tool," the Committee misses the point that the Schrodinger equation is not physical since it deals with an all space (everywhere at once) point-particle probability wave. It also does not give the correct solution of the energy levels of even the simplest atom, hydrogen. It misses spin, the electron g factor, the Lamb shift, the fine structure, the hyperfine structure, degeneracy of excited states, lack relativistic invariance, is not stable to radiation of the n=1 state, violates conservation of energy and angular momentum as well as casualty to mention just a few of the fatal flaws as pointed out in previous publications:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at

http://www.blacklightpower.com/techpapers.shtml.

2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.

3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.

8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

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Beyond the simplest atom, nothing can be solved using outdated quantum theory since the mathematics involves multi-body problems. Approximations with nonphysical assumptions and adjustable parameters are the techniques employed, wherein physics is replaced by untestable pure mathematics. Further, the mathematics associated with quantum theory is obviously internally inconsistent, since no two theoreticians use the same adjustable parameters, and, thus, that flawed theory fails to meet the Committee's own credibility standard.

This ad hoc approach is extended to molecule solutions. For example citing from Applicant's paper [R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389], in Table 9-1, McQuarrie [D. A. McQuarrie, Quantum Chemistry, University Science Books, Mill Valley, CA, (1983), pp. 343-422] presents 13 different methods for the calculation of the parameters of the hydrogen molecule. None are rigorous, physical, unique, and internally consistent, and the methods are themselves internally inconsistent and often contradictory. The number of terms in the wavefunctions span two to 100 and all involve mixing of the wavefunctions as given in Eq. (3-5) with variable parameters. Exemplary algorithms include valence bond, valence bond plus ionic terms, molecular orbital theory, molecular-orbital with configuration interaction, self consistent field method, SCF-LCAO-MO, Hartree-Fock, valence-shell electron-pair-repulsion (VSEPR) method, etc. In all of these and other such approaches, there is total disregard to conservation of energy, momentum, and radiation according to Maxwell's equations. The approaches involve an inconsistent plethora of invented wavefunctions and terms— Slater orbitals, ionic terms, molecular orbital with sigma bonds, pi bonds, delta bond, banana bonds, bonding orbitals, antibonding orbitals, (negative probability density as well as positive probability density), back-bonding orbitals (empty space), overlap, coulomb, and exchange integrals—all with intractable infinities. Ad hoc, inconsistent types of adjustable parameters such as effective nuclear charge, ionic character, correlation interactions, and arbitrary renormalization procedures to remove infinities are introduced to force the calculations to match observations.

In contrast, Applicant uses physical laws to exactly solve the energy levels of atoms, excited states, spin, the electron g factor, the Lamb shift, the fine structure, the hyperfine structure, degeneracy of excited states, relativistic invariance, stability to radiation of the n=1 state, and conservation of energy and angular momentum as given in the above cited references 1-10. These results are extended to give exact solutions of polyatomic molecules as given in Chps. 11, 13 and 14 of Mills GUT, an achievement that is unmatched by SQM.

On pages 8-9 of the Consolidated Appendix, the Committee further incorrectly states:

From a consideration of Mills's mathematical derivations on pages
4-5 (equation (1.5) to (LI 1), on pages 32-38 (equations (1.3) to (1.45))
and on pages 136-141 (equations (5.1) to (5.21)) of GUT (1999 edition), it
appears that Mills's formulation may be an integral equation type of
approach. Specifically, the boundary condition "built into" the integral
equation is an expression for the current density, and thus, the charge
density of a point charge which satisfies Maxwell's equations for the
electric field as given by Haus in a paper, in the American Journal of
Physics, vol. 54, no. 12, pages 1126-1120 (1986), relating to the absence
of radiation from a point charge moving at constant velocity. See page 3 of
GUT (1999 edition).

While Haus's paper is not the focus of discussion here, it is
apparent that the use of a Dirac delta function , 8(r-rJ to represent the
electron charge density on page 4 of GUT (1999 edition) is an unphysical
assumption by applicant in that, whereas the electron charge density is an
"observable" that is ultimately measurable, the delta function, which
purports to represent it, is not, in and of itself a function in the usual
mathematical sense of the term and is physically meaningful only under
an integral sign (see Section 10 for more a detailed discussion).

·In any event, at least some problematic issues are seen in Mills's
treatment of the hydrogen atom, viz., (i) there is no explanation why it is
physically meaningful to utilize Haus's boundary condition for a classical
point charge moving in free space in order to obtain the energy levels of
the electron in a quantized system such as the hydrogen atom (or in a one
electron atom having an atomic mass of at least four) where the electron
moves in a confined space due to its attractive Coulombic interaction with
the positively charged nucleus,

As stated numerous times previously, Applicant correctly uses Haus's boundary
condition and Dirac delta function. The Committee is stuck in his myopic view according
to outdated quantum theory that the electron must move in the radial direction and be a
solution of the three-dimensional wave equation plus time. There is no a priori reason
for this to be the case. If fact, it can't be. Since the electron is bound in an inverse-
squared central field, any radial motion must result in a change in the angular
momentum and the total energy of the electron. Since the total energy is constant (13.6
eV), this can not be the case. The radial Dirac delta function corresponds to the two-
dimensional wave equation plus time. This wave equation gives the correct physics of
constant energy and angular momentum and provides for the stability of the bound

electron to radiation in accordance with Maxwell's equations. See, for example:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Fondation Louis de Broglie, submitted.

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5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2005 Edition posted at www.blacklightpower.com.

As given in many instances, such as the Introduction of Mills GUT (Ref. #1):

CQM APPROACH TO THE SOLUTION OF THE ELECTRON

CQM solves the electron by a different approach than that used to solve the Schrödinger wave equation. Rather than using a postulated wave equation with time eliminated in terms of the energy of the electron in a Coulomb field and solving the charge wave (Schrödinger interpretation) or the probability wave (Born interpretation), the solution for the scalar (charge) and vector potential (current) functions of the electron are sought based on first principles. CQM first assumes that the functions that physically describe the mass and charge of the electron in space and time obey the wave equation since it conserves energy and angular momentum. The solution is initially generalized to be three dimensional plus time. Rather than use the postulated Schrödinger boundary

condition: "$\Psi \to 0$ as $r \to \infty$", which leads to a purely mathematical model of the electron, the constraint is based on the experimental observation that the moving charge must not radiate. Application of the Haus' condition based on Maxwell's equations to a generalized three dimension plus time wave equation requires that the functions must be solutions of Eq. (I.16), a two dimensional wave equation plus time. This is consistent with first principle laws and ultimately matches experimentation. However, it is unconventional.

The two dimensional wave equation plus time is given by McQuarrie [2]. It is mathematically identical to the familiar rigid rotor equation of QM. The electron is confined to two dimensions (θ and ϕ) plus time, and the corresponding wave equation solution is called an electron orbitsphere. Spherical harmonic functions and time harmonic functions are well known solutions of the angular and time components of the two dimensional wave equation plus time, respectively. The solutions appear in McQuarrie [3]. A constant current function is also a solution of the wave equation. A constant function corresponding to the electron spin function is added to each of the spherical harmonic functions to give the charge (mass)-density functions of the electron as a function of time. The integral of a spherical harmonic function over the orbitsphere is zero. The integral of the constant function over the orbitsphere is the total charge (mass) of the electron. These functions comprise the well known s, p, d, f, etc. electrons or orbitals. In the case that such an electron state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current-density function since it possesses spacetime Fourier components synchronous with waves traveling at the speed of light as shown in the Instability of the Excited States section.

The excited states are solved including the radii of the orbitspheres using Maxwell's equations with the traditional source current boundary constraints at the electron. Quantization arises from the equation of the photon and the electron—not from the solution of the electron alone. After all, each solution models an excited state created by the absorption of a photon. The solutions are analogous to those of excited resonator modes except that the cavity is dynamic. The field lines from the proton end on the current-density function of the electron, and the electric field is zero for $r > r_n$. The trapped photons are a solution of the three dimensional wave equation plus time given by Maxwell's equations. The electrodynamic field of the photon is a constant function plus a time and spherical harmonic function that is in phase with source currents at the electron which is given by a constant plus a time and spherical harmonic function. Only particular solutions are possible as resonant photons of the electron which is a dynamic resonator cavity. The results are in agreement with first principle physics and experimental observations of the hydrogen atom, excited

states, free electron, and free space photon including the wave particle
duality aspects.

SPIN AND ORBITAL PARAMETERS ARISE FROM FIRST PRINCIPLES

An electron is a spinning, two-dimensional spherical surface, called
an *electron orbitsphere*, that can exist in a bound state only at specific
radii r_n from the nucleus. (See Figure 1.1 for a pictorial representation of
an orbitsphere.) The result for the $n = 1$ state of hydrogen is that the
charge-density function remains constant with each point on the surface
moving at the same angular and linear velocity. The constant function
solution of the two dimensional wave equation corresponds to the spin
function which has a corresponding spin angular momentum that may be
calculated from $\mathbf{r} \times \mathbf{p}$ applied directly to the current-density function that
describes the electron. The radius of the nonradiative ($n = 1$) state is
solved using the electromagnetic force equations of Maxwell relating the
charge and mass-density functions wherein the angular momentum of the
electron is $\hbar$ (Eq. (1.165)). The reduced mass arises naturally from an
electrodynamic interaction between the electron and the proton rather
than from a point mass revolving around a point nucleus in the case of
Schrödinger wave equation solutions which presents an internal
inconsistency since the wave functions are spherically symmetrical.

CQM gives closed form solutions for the resonant photons and
excited state electron functions. The free space photon also comprises a
radial Dirac delta function, and the angular momentum of the photon given

by $\mathbf{m} = \int \frac{1}{8\pi c} \mathrm{Re}[\mathbf{r} \times (\mathbf{E} \times \mathbf{B}^*)]dx^4 = \hbar$ in the Photon section is conserved for

the solutions for the resonant photons and excited state electron functions.
It can be demonstrated that the resonance condition between these
frequencies is to be satisfied in order to have a net change of the energy
field [4]. In the present case, the correspondence principle holds. That is
the change in angular frequency of the electron is equal to the angular
frequency of the resonant photon that excites the resonator cavity mode
corresponding to the transition, and the energy is given by Planck's
equation. The predicted energies, Lamb shift, fine structure splitting,
hyperfine structure, resonant line shape, line width, selection rules, etc.
are in agreement with observation.

The radii of excited states are solved using the electromagnetic
force equations of Maxwell relating the field from the charge of the proton,
the electric field of the photon, and charge and mass-density functions of
the electron wherein the angular momentum of the electron is $\hbar$ (Eq.
(1.165)).

For excited states of the hydrogen atom, the constant function solution of the two dimensional wave equation corresponds to the spin function. Each spherical harmonic function modulates the constant spin function and corresponds to an orbital function of a specific excited state with a corresponding phase-matched trapped photon and orbital angular momentum. Thus, the spherical harmonic function behaves as a charge-density wave which travels time harmonically on the surface of the orbitsphere about a specific axis. (See Figure 1.2 for a pictorial representation.) The amplitude of the corresponding orbital energy may be calculated from Maxwell's equations. Since the constant function is modulated harmonically, the time average of the orbital energy is zero except in the presence of a magnetic field. Nondegeneracy of energy levels arises from spin, orbital, and spin-orbital coupling interactions with the applied field. The electrodynamic interaction with the magnetic field gives rise to the observed hyperfine splitting of the hydrogen spectrum.

Many inconsistencies arise in the case of the corresponding solutions of the Schrödinger wave equation. For example, where is the photon in excited states given by the Schrödinger equation? And, a paradox arises for the change in angular momentum due to photon absorption. The Schrödinger equation solutions for the kinetic energy of rotation K_{rot} is given by Eq. (10) of ref. [5] and the value of the electron angular momentum L for the state $Y_{lm}(\theta,\phi)$ is given by Eq. (11) of ref. [5]. They predict that the excited state rotational energy levels are nondegenerate as a function of the ℓ quantum number even in the absence of an applied magnetic field, and the predicted energy is over six orders of magnitude of the observed nondegenerate energy in the presence of a magnetic field. In the absence of a magnetic field, no preferred direction exists. In this case, the ℓ quantum number is a function of the orientation of the atom with respect to an arbitrary coordinate system. Therefore, the nondegeneracy is nonsensical and violates conservation of angular momentum of the photon.

In quantum mechanics, the spin angular momentum of the electron is called the "intrinsic angular momentum" since no physical interpretation exists. The Schrödinger equation is not Lorentzian invariant in violation of special relativity. It fails to predict the results of the Stern-Gerlach experiment which indicates the need for an additional quantum number. Quantum Electrodynamics (QED) was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. It is fatally flawed. From Weisskopf [6], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum

electrodynamics; 1.) DOES NOT EXPLAIN NONRADIATION OF BOUND ELECTRONS; 2.) contains an internal inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite (the Schrödinger equation fails to predict the classical electron radius); 3.) it admits solutions of negative rest mass and negative kinetic energy; 4.) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; 5.) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. Dirac's equation which was postulated to explain spin relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors. All of these features are untenable or are inconsistent with observation. These problems regarding spin and orbital angular momentum and energies and the classical electron radius are nonexistent with CQM solutions.

Furthermore, the mathematical relationship whereby the Schrödinger equation may be transformed into a form consistent with first principles is shown *infra*. In the case that the potential energy of the Hamiltonian, H, is a constant times the wavenumber, the Schrödinger equation is the well known Bessel equation. Then one of the solutions for the wavefunction Ψ (a current-density function rather than a probability wave) is equivalent to an inverse Fourier transform. According to the duality and scale change properties of Fourier transforms, the energy equation of CQM and that of quantum mechanics are identical, the energy of a radial Dirac delta function of radius equal to an integer multiple of the radius of the hydrogen atom.

CLASSICAL QUANTUM THEORY

One-electron atoms include the hydrogen atom, He^+, Li^{2+}, Be^{3+}, and so on. The mass-energy and angular momentum of the electron are constant; this requires that the equation of motion of the electron be temporally and spatially harmonic. Thus, the classical wave equation applies and

$$\left[\nabla^2 - \frac{1}{v^2} \frac{\partial^2}{\partial t^2} \right] \rho(r,\theta,\phi,t) = 0 \qquad (1.2)$$

where $\rho(r,\theta,\phi,t)$ is the charge-density function of the electron in time and space. In general, the wave equation has an infinite number of solutions. To arrive at the solution which represents the electron, a suitable boundary condition must be imposed. It is well known from experiments that each single atomic electron of a given isotope radiates to the same stable state. Thus, CQM uses the physical boundary condition of nonradiation of the bound electron to be imposed on the solution of the wave equation for the charge-density function of the electron. The

condition for radiation by a moving point charge given by Haus [7] is that its spacetime Fourier transform possesses components that are synchronous with waves traveling at the speed of light. Conversely, it is proposed that the condition for nonradiation by an ensemble of moving point charges that comprises a charge-density function is

For non-radiative states, the current-density function must NOT possess spacetime Fourier components that are synchronous with waves traveling at the speed of light.

The Haus derivation applies to a moving charge-density function as well because charge obeys superposition. The Haus derivation is summarized below.

The Fourier components of the current produced by the moving charge are derived. The electric field is found from the vector equation in Fourier space ($\mathbf{k}$, ω-space). The inverse Fourier transform is carried over the magnitude of $\mathbf{k}$. The resulting expression demonstrates that the radiation field is proportional to $\mathbf{J}_{\perp}(\frac{\omega}{c}\mathbf{n},\omega)$, where $\mathbf{J}_{\perp}(\mathbf{k},\omega)$ is the spacetime Fourier transform of the current perpendicular to $\mathbf{k}$ and $\mathbf{n} \equiv \frac{\mathbf{k}}{|k|}$. Specifically,

$$\mathbf{E}_{\perp}(\mathbf{r},\omega)\frac{d\omega}{2\pi} = \frac{c}{2\pi}\int\rho(\omega,\Omega)d\omega d\Omega\sqrt{\frac{\mu_0}{\varepsilon_0}}\mathbf{n}\,X\left(\mathbf{n}\,X\mathbf{J}_{\perp}\left(\frac{\omega}{c}\mathbf{n},\omega\right)e^{i\left(\frac{\omega}{c}\right)\mathbf{n}\cdot\mathbf{r}}\right) \quad (\text{I}.3)$$

The field $\mathbf{E}_{\perp}(\mathbf{r},\omega)\frac{d\omega}{2\pi}$ is proportional to $\mathbf{J}_{\perp}\left(\frac{\omega}{c}\mathbf{n},\omega\right)$, namely, the Fourier component for which $\mathbf{k} = \frac{\omega}{c}$. Factors of ω that multiply the Fourier component of the current are due to the density of modes per unit volume and unit solid angle. An unaccelerated charge does not radiate in free space, not because it experiences no acceleration, but because it has no Fourier component $\mathbf{J}_{\perp}\left(\frac{\omega}{c}\mathbf{n},\omega\right)$. (Nonradiation is also shown directly using Maxwell's equations in Appendix I: Nonradiation Based on the Electromagnetic Fields and the Poynting Power Vector.)

The time, radial, and angular solutions of the wave equation are separable. The motion is time harmonic with frequency ω_n. To be a harmonic solution of the wave equation in spherical coordinates, the angular functions must be spherical harmonic functions. A zero of the spacetime Fourier transform of the product function of two spherical harmonic angular functions, a time harmonic function, and an unknown radial function is sought. The solution for the radial function which

satisfies the boundary condition is a delta function

$$f(r) = \frac{1}{r^2} \delta(r - r_n) \qquad (I.4)$$

where $r_n = nr_1$ is an allowed radius. Thus, bound electrons are described by a charge-density (mass-density) function which is the product of a radial delta function ($f(r) = \frac{1}{r^2} \delta(r - r_n)$), two angular functions (spherical harmonic functions), and a time harmonic function. Thus, an electron is a spinning, two-dimensional spherical surface, called an *electron orbitsphere*, that can exist in a bound state at only specified distances from the nucleus as shown in Figure 1.1. More explicitly, the orbitsphere comprises a two-dimensional spherical shell of moving charge.

The total function that describes the spinning motion of each electron orbitsphere is composed of two functions. One function, the spin function, is spatially uniform over the orbitsphere, spins with a quantized angular velocity, and gives rise to spin angular momentum. The other function, the modulation function, can be spatially uniform—in which case there is no orbital angular momentum and the magnetic moment of the electron orbitsphere is one Bohr magneton—or not spatially uniform—in which case there is orbital angular momentum. The modulation function also rotates with a quantized angular velocity.

The uniform current density function $Y_0^0(\phi, \theta)$, the orbitsphere equation of motion of the electron (Eqs. (1.64-1.65)), corresponding to the constant charge function of the orbitsphere that gives rise to the spin of the electron is generated from a basis set current-vector field defined as the orbitsphere current-vector field ("orbitsphere-cvf"). This in turn is generated from orthogonal great circle current loops that serve as basis elements. In Appendix III, the *continuous* uniform electron current density function $Y_0^0(\phi, \theta)$ (Eqs. (1.64-1.65)) is then exactly generated from this orbitsphere-cvf as a basis element by a convolution operator comprising an autocorrelation-type function.

The orbitsphere-cvf comprises an infinite series of correlated orthogonal great circle current loops. The current pattern is generated over the surface by two sets of an infinite series of nested rotations of two orthogonal great circle current loops where the coordinate axes rotate with the two orthogonal great circles. Each infinitesimal rotation of the infinite series is about the new i'-axis and new j'-axis which results from the preceding such rotation. For each of the two sets of nested rotations, the angular sum of the rotations about each rotating i'-axis and j'-axis totals $\frac{\sqrt{2}}{2}\pi$ radians.

Consider the electron to be evenly distributed within two sets of orthogonal great circle current loops for Steps One and Two. Then,

consider two infinitesimal point mass (charge)-density elements, one and two, of one set of two orthogonal great circle current loops wherein initially the first current loop lies in the yz-plane, and the second current loop lies in the xz-plane. The xyz Cartesian coordinate frame is designated the laboratory reference frame. The algorithm to generate the orbitsphere-cvf rotates the great circles and the corresponding coordinates relative to the xyz frame. A primed Cartesian coordinate system refers to the axes that rotate with the great circles and determines the basis-set reference frame. Each element of the current pattern is obtained with each conjugate set of rotations. For Step One, consider two such infinitesimal charges (masses) at points one (moving counter clockwise on the great circle in the y'z'-plane) and two (moving clockwise on the great circle in the x'z'-plane) of two orthogonal great circle current loops in the basis frame are considered as sub-basis elements to generate the current density corresponding to the spin quantum number, $s = \dfrac{1}{2}$; $m_s = \pm\dfrac{1}{2}$. Initially element one is at $x' = 0$, $y' = 0$, and $z' = r_n$ and element two is at $x' = r_n$, $y' = 0$, and $z' = 0$ as shown in Figure 1.4A. The equations of motion, in the sub-basis-set reference frame are given by

point one:

$$x_1' = 0 \qquad y_1' = -r_n \sin(\omega_n t) \qquad z_1' = r_n \cos(\omega_n t) \qquad \text{(I.5a)}$$

point two:

$$x_2' = r_n \cos(\omega_n t) \qquad y_2' = 0 \qquad z_2' = r_n \sin(\omega_n t) \qquad \text{(I.5b)}$$

For Step Two, consider two charge (mass)-density elements, point one and two, in the basis-set reference frame at time zero. Element one is at $x' = 0$, $y' = r_n$, and $z' = 0$ and element two is at $x' = r_n$, $y' = 0$, and $z' = 0$. Let element one move clockwise on a great circle toward the -z'-axis as shown in Figure 1.4B, and let element two move counter clockwise on a great circle toward the y'-axis as shown in Figure 1.4B. The equations of motion, in the basis-set reference frame are given by

point one:

$$x_1' = 0 \qquad y_1' = r_n \cos(\omega_n t) \qquad z_1' = -r_n \sin(\omega_n t) \qquad \text{(I.6a)}$$

point two:

$$x'_2 = r_n \cos(\omega_n t) \qquad y'_2 = r_n \sin(\omega_n t) \qquad\qquad z'_2 = 0 \qquad \text{(I.6b)}$$

The great circles are rotated by an infinitesimal angle $\pm\Delta\alpha_i$ (a rotation around the x'-axis or z'-axis for Steps One and Two, respectively) and then by $\pm\Delta\alpha_j$ (a rotation around the new y'-axis or x'-axis for Steps One and Two, respectively) where the rotation directions are shown in Figures 1.4A and 1.4B, respectively. The coordinates of each point on each rotated great circle (x',y',z') is expressed in terms of the first (x,y,z) coordinates by the following transforms where clockwise rotations are defined as positive:

Step One

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & 0 & -\sin(\Delta\alpha_y) \\ 0 & 1 & 0 \\ \sin(\Delta\alpha_y) & 0 & \cos(\Delta\alpha_y) \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & \sin(\Delta\alpha_y)\sin(\Delta\alpha_x) & -\sin(\Delta\alpha_y)\cos(\Delta\alpha_x) \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_y) & -\cos(\Delta\alpha_y)\sin(\Delta\alpha_x) & \cos(\Delta\alpha_y)\cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\text{(I.7)}$$

Step Two

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\sin(\Delta\alpha_z) & \cos(\Delta\alpha_z) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\cos(\Delta\alpha_x)\sin(\Delta\alpha_z) & \cos(\Delta\alpha_x)\cos(\Delta\alpha_z) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_x)\sin(\Delta\alpha_z) & -\sin(\Delta\alpha_x)\cos(\Delta\alpha_z) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

(I.8)

where the angular sum is $\displaystyle\lim_{\Delta\alpha \to 0} \sum_{n=1}^{\frac{\frac{\sqrt{2}}{2}\pi}{|\Delta\alpha_{i,j}|}} |\Delta\alpha_{i,j}| = \frac{\sqrt{2}}{2}\pi$.

The orbitsphere-cvf is given by n reiterations of Eqs. (I.7) and (I.8) for each point on each of the two orthogonal great circles during each of Steps One and Two where the sign of $\pm\Delta\alpha_i$ and $\pm\Delta\alpha_j$, for each Step are given in Table 1.1. The output given by the non-primed coordinates is the input of the next iteration corresponding to each successive nested rotation by the infinitesimal angle $\pm\Delta\alpha_i$ or $\pm\Delta\alpha_j$, where the magnitude of the angular sum of the n rotations about each of the i'-axis and the j'-axis is $\frac{\sqrt{2}}{2}\pi$. Half of the orbitsphere-cvf is generated during each of Steps One and Two.

Following Step Two, in order to match the boundary condition that the magnitude of the velocity at any given point on the surface is given by Eq. (1.56), the output half of the orbitsphere-cvf is rotated clockwise by an angle of $\frac{\pi}{4}$ about the z-axis. Using Eq. (I.8) with $\Delta\alpha_z = \frac{\pi}{4}$ and $\Delta\alpha_x = 0$ gives the rotation. Then, the one half of the orbitsphere-cvf generated from Step One is superimposed with the complementary half obtained from Step Two following its rotation about the z-axis of $\frac{\pi}{4}$ to give the orbitsphere-cvf.

The current pattern of the orbitsphere-cvf generated by the nested rotations of the orthogonal great circle current loops is a continuous and total coverage of the spherical surface, but it is shown as visual

representations using 6 degree increments of the infinitesimal angular variable $\pm\Delta\alpha_i$ and $\pm\Delta\alpha_{j'}$ of Eqs. (I.7) and (I.8) from six perspectives in Figures 1.5A-F. In each case, the complete orbitsphere-cvf current pattern corresponds to all the correlated points, points one and two, of the orthogonal great circles shown in Figures 1.4A and 1.4B which are rotated according to Eqs. (I.7) and (I.8) where $\pm\Delta\alpha_i$ and $\pm\Delta\alpha_{j'}$ approach zero and the summation of the infinitesimal angular rotations of $\pm\Delta\alpha_i$ and $\pm\Delta\alpha_{j'}$ about the successive i'-axes and j'-axes is $\dfrac{\sqrt{2}}{2}\pi$ for each Step. The current pattern gives rise to the phenomenon corresponding to the spin quantum number.

The resultant angular momentum projections of $\mathbf{L}_{xy} = \dfrac{\hbar}{4}$ and $\mathbf{L}_z = \dfrac{\hbar}{2}$ meet the boundary condition for the unique current having an angular velocity magnitude at each point on the surface given by Eq. (1.56) and give rise to the Stern Gerlach experiment as shown in the Magnetic Parameters of the Electron (Bohr Magneton) section, and in the Electron g Factor section. The further constraint that the current density is uniform such that the charge density is uniform, corresponding to an equipotential, minimum energy surface is satisfied by using the orbitsphere-cvf as a basis element to generate $Y_0^0(\phi,\theta)$ using a convolution operator comprising an autocorrelation-type function as given in Appendix III. The operator comprises the convolution of each great circle current loop of the orbitsphere-cvf designated as the primary orbitsphere-cvf with a second orbitsphere-cvf designated as the secondary orbitsphere-cvf.

The orbitsphere-cvf comprises two components corresponding to each of STEP ONE and STEP TWO. As shown for STEP TWO, the angular momentum vector is stationary on the $\left(-\dfrac{1}{\sqrt{2}}\mathbf{i}_x, \dfrac{1}{\sqrt{2}}\mathbf{i}_y, \mathbf{i}_z\right)$-axis as the component orbitsphere-cvf is generated by the series of nested rotations using Eq. (1.70b). It is shown in Appendix III that STEP TWO can also be generated by a 2π-rotation of a single basis-element current loop about the $\left(-\dfrac{1}{\sqrt{2}}\mathbf{i}_x, \dfrac{1}{\sqrt{2}}\mathbf{i}_y, \mathbf{i}_z\right)$-axis. In the general case that the resultant angular momentum of each pair of orthogonal great circle current loops of the component orbitsphere-cvf is along the 2π-rotational axis (defined as the rotational axis which generates the component orbitsphere-cvf from a basis-element great circle), a secondary nth component orbitsphere-cvf can serve as a basis element to match the angular momentum of any given nth great circle of a primary component orbitsphere-cvf. The replacement of each great circle of the primary orbitsphere-cvf with a secondary orbitsphere-cvf of matching angular momentum, orientation,

and phase comprises an autocorrelation-type function that exactly gives rise to the spherically-symmetric current density, $Y_0^0(\phi, \theta)$, as the sum of two uniform spherical contributions from each component. The resulting exact uniform current distribution obtained from the convolution has the same angular momentum distribution, resultant, $\mathbf{L_R}$, and components of $\mathbf{L}_{xy} = \dfrac{\hbar}{4}$ and $\mathbf{L}_z = \dfrac{\hbar}{2}$ as those of the orbitsphere-cvf used as a primary basis element.

In contrast to the QM and QED cases (See Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality), the fourth quantum number arises naturally in CQM as derived in the Electron g Factor section. The Stern-Gerlach experiment implies a magnetic moment of one Bohr magneton and an associated angular momentum quantum number of 1/2. Historically, this quantum number is called the spin quantum number, s ($s = \dfrac{1}{2}$; $m_s = \pm\dfrac{1}{2}$). Conservation of angular momentum of the orbitsphere permits a discrete change of its "kinetic angular momentum" ($\mathbf{r} \times m\mathbf{v}$) with respect to the field of $\dfrac{\hbar}{2}$, and concomitantly the "potential angular momentum" ($\mathbf{r} \times e\mathbf{A}$) must change by $-\dfrac{\hbar}{2}$. The flux change, ϕ, of the orbitsphere for $r < r_n$ is determined as follows:

$$\Delta\mathbf{L} = \frac{\hbar}{2} - \mathbf{r} \times e\mathbf{A} \tag{I.9}$$

$$= \left[\frac{\hbar}{2} - \frac{e2\pi rA}{2\pi}\right]\hat{z} \tag{I.10}$$

$$= \left[\frac{\hbar}{2} - \frac{e\phi}{2\pi}\right]\hat{z} \tag{I.11}$$

In order that the change of angular momentum, $\Delta\mathbf{L}$, equals zero, ϕ must be $\Phi_0 = \dfrac{h}{2e}$, the magnetic flux quantum. Thus, to conserve angular momentum in the presence of an applied magnetic field, the orbitsphere magnetic moment can be parallel or antiparallel to an applied field as observed with the Stern-Gerlach experiment, and the flip between orientations is accompanied by the "capture" of the magnetic flux quantum by the orbitsphere. During the spin-flip transition, power must be conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \bullet (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o\mathbf{H} \bullet \mathbf{H}\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o\mathbf{E} \bullet \mathbf{E}\right] - \mathbf{J} \bullet \mathbf{E} \tag{I.12}$$

Eq. (I.13) derived in the Electron g Factor section gives the total energy of the flip transition which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric

energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively.

$$\Delta E_{mag}^{spin} = 2\left(1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2\right)\mu_B B \qquad (\text{I.13})$$

$$\Delta E_{mag}^{spin} = g\mu_B B \qquad (\text{I.14})$$

The spin-flip transition can be considered as involving a magnetic moment of g times that of a Bohr magneton. The g factor is redesignated the fluxon g factor as opposed to the anomalous g factor. The calculated value of $\frac{g}{2}$ is 1.001 159 652 137. The experimental value [8] of $\frac{g}{2}$ is 1.001 159 652 188(4).

CQM solves the wave equation for the charge-density function of the electron. The time, radial, and angular solutions of the wave equation are separable. Also, the radial function for the electron indicates that the electron is two-dimensional. Therefore, the angular mass-density function of the electron, $A(\theta, \phi, t)$, must be a solution of the wave equation in two dimensions (plus time). EQ. (I.2) becomes

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]A(\theta, \phi, t) = 0 \qquad (\text{I.15})$$

where $\rho(r, \theta, \phi, t) = f(r)A(\theta, \phi, t) = \frac{1}{r^2}\delta(r - r_n)A(\theta, \phi, t)$ and

$A(\theta, \phi, t) = Y(\theta, \phi)k(t)$. Specifically, the wave equation is

$$\left[\frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial}{\partial\theta}\right)_{r,\phi} + \frac{1}{r^2\sin^2\theta}\left(\frac{\partial^2}{\partial\phi^2}\right)_{r,\theta} - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]A(\theta, \phi, t) = 0 \quad (\text{I.16})$$

where v is the linear velocity of the electron. The charge-density functions including the time-function factor are

$\ell = 0$

$$\rho(r, \theta, \phi, t) = \frac{e}{8\pi r^2}[\delta(r - r_n)]\left[Y_0^0(\theta, \phi) + Y_\ell^m(\theta, \phi)\right] \qquad (\text{I.17})$$

$\ell \neq 0$

$$\rho(r, \theta, \phi, t) = \frac{e}{4\pi r^2}[\delta(r - r_n)]\left[Y_0^0(\theta, \phi) + \text{Re}\{Y_\ell^m(\theta, \phi)e^{i\omega_n t}\}\right] \qquad (\text{I.18})$$

where $\text{Re}\{Y_\ell^m(\theta, \phi)e^{i\omega_n t}\} = P_\ell^m(\cos\theta)\cos(m\phi + \omega_n t)$ and to keep the form of the spherical harmonic as a traveling wave about the z-axis, $\omega_n' = m\omega_n$.

The spin function of the electron (see Figure 1.1 for the charge function and Figure 1.5A for the current function) corresponds to the nonradiative $n = 1$, $\ell = 0$ state of atomic hydrogen which is well known as an s state or orbital. The constant spin function is modulated by a time

and spherical harmonic function as given by Eq. (I.18) and shown in Figure 1.2. The modulation or traveling charge-density wave corresponds to an orbital angular momentum in addition to a spin angular momentum. These states are typically referred to as p, d, f, etc. orbitals and correspond to an ℓ quantum number not equal to zero. Application of the condition from Haus [7] (Eqs, (I.19-I.21)) also predicts nonradiation for a constant spin function modulated by a time and spherically harmonic orbital function. There is acceleration without radiation. (Also see Abbott and Griffiths and Goedecke [9-10]). Nonradiation is also shown directly using Maxwell's equations in Appendix I: Nonradiation Based on the Electromagnetic Fields and the Poynting Power Vector. However, in the case that such a state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current-density function since it possesses spacetime Fourier transform components synchronous with waves traveling at the speed of light as shown in the Instability of Excited States section.

The Fourier transform of the electron charge-density function is a solution of the four-dimensional wave equation in frequency space ($\mathbf{k}$, ω-space). Then the corresponding Fourier transform of the current-density function $K(s,\Theta,\Phi,\omega)$ is given by multiplying by the constant angular frequency.

$$K(s,\Theta,\Phi,\omega) = 4\pi\omega_n \frac{\sin(2s_n r_n)}{2s_n r_n} \otimes 2\pi\sum_{\upsilon=1}^{\infty} \frac{(-1)^{\upsilon-1}(\pi\sin\Theta)^{2(\upsilon-1)}}{(\upsilon-1)!(\upsilon-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(\upsilon+\frac{1}{2}\right)}{(\pi\cos\Theta)^{2\upsilon+1}2^{\upsilon+1}} \frac{2\upsilon!}{(\upsilon-1)!}s^{-2\upsilon}$$

$$\otimes 2\pi\sum_{\upsilon=1}^{\infty} \frac{(-1)^{\upsilon-1}(\pi\sin\Phi)^{2(\upsilon-1)}}{(\upsilon-1)!(\upsilon-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(\upsilon+\frac{1}{2}\right)}{(\pi\cos\Phi)^{2\upsilon+1}2^{\upsilon+1}} \frac{2\upsilon!}{(\upsilon-1)!}s^{-2\upsilon}\frac{1}{4\pi}[\delta(\omega-\omega_n)+\delta(\omega+\omega_n)]$$

(I.19)

The motion on the orbitsphere is angular; however, a radial component exists due to special relativistic effects. Consider the radial wave vector of the sinc function. When the radial projection of the velocity is c

$$\mathbf{s}_n \bullet \mathbf{v}_n = \mathbf{s}_n \bullet \mathbf{c} = \omega_n \qquad\qquad (I.20)$$

the relativistically corrected wavelength is

$$r_n = \lambda_n \qquad\qquad (I.21)$$

(i.e. the lab frame motion in the angular direction goes to zero as the velocity approaches the speed of light). Substitution of Eq. (I.21) into the sinc function results in the vanishing of the entire Fourier transform of the current-density function. Thus, spacetime harmonics of $\frac{\omega_n}{c} = k$ or

$\frac{\omega_n}{c}\sqrt{\frac{\varepsilon}{\varepsilon_o}} = k$ for which the Fourier transform of the current-density function

is nonzero do not exist. Radiation due to charge motion does not occur in any medium when this boundary condition is met.

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On page 9 of the Consolidated Appendix, the Committee further incorrectly states:

> (ii) there is no persuasive explanation for the catastrophic collapse of the electron into the nucleus at n in the fractional quantum number series, $1/n$, i.e., the hydrino atom implodes and ceases to exist. See pages 144-146 of GUT (1999 edition). The end result of Mills's theory fails to bear out his assertion that n must unequivocally have fractional values.

As stated previously, this is not true based on conservation of energy as disclosed in Chapter 5 of R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, January 2000 Edition, BlackLight Power, Inc., Cranbury, New Jersey, distributed by Amazon.com, as

well as the earlier versions of Applicant's book, which are incorporated by reference into the subject application.

Applicant never stated or alleged that the hydrino atom implodes. The Committee has it completely backwards. Applicant's theory does not result in the electron contacting the nucleus, whereas the Schrodinger equation cited by the Committee actually requires that the electron must exist in the nucleus part of the time, as discussed above. These overly simplistic arguments further demonstrate the Committee's improper approach of taking Applicant's teachings out of context to reach nonsensical conclusions.

Applicant's teachings clearly state the following:

NEW "GROUND" STATE

Hydrogen atoms can undergo transitions to energy states below the ground state [13.6 eV] until the total potential energy of the proton is converted to relativistically corrected kinetic energy and total energy (the negative of the binding energy). The potential energy V of the electron and the proton separated by the radial distance radius r_1 is,

$$V = \frac{-e^2}{4\pi\varepsilon_o r_1} \tag{5.72}$$

where the radius r_1 is the proton radius given by Eq. (28.1)

$$r_p = 1.3 \times 10^{-15} \, m \tag{5.73}$$

Substitution of Eq.(5.73) into Eq.(5.72) gives the total potential energy V of the electron and the proton

$$V = \frac{-e^2}{4\pi\varepsilon_o r_p} = 1.1 \times 10^6 \, eV \tag{5.74}$$

Thus, Applicant's theory clearly provides limits on how low of an energy state the electron can be taken using Applicant's novel nonradiative transfer of energy from the hydrogen atom. Applicant's theory does not state that the electron catastrophically collapses into the nucleus and the Committee has no basis for making such an absurd allegation.

On pages 9-10 of the Consolidated Appendix, the Committee further incorrectly states:

Applicant's theory does not show that conventional quantum mechanical treatment of the hydrogen atom (referred to as SQM by applicant) is theoretically or experimentally flawed (see Sections 4-10). Any attempt to establish a new result for the hydrogen atom that is

presently unknown to quantum mechanics must cross a rather steep threshold of scientific credibility.

Applicant is no less astonished each time the Committee raises the argument that his invention is "unknown to quantum mechanics" as one of the primary bases for its present rejections. Applicant is fully aware that his technology, prior to its disclosure by him, was unknown to that outdated theory, which is precisely what makes it so novel and therefore patentable.

It is further noted that the Committee now fabricates yet another new standard Applicant must meet, i.e., the "steep threshold of scientific credibility" standard, which also finds no basis in law. Nonetheless, Applicant has met this baseless standard with the publication of his experimental evidence in 65 peer-reviewed journal articles as the Committee previously required—evidence that it admitted was deserving of "credibility." In any case, given that Applicant has shown how outdated quantum theory is fatally flawed, which even the Committee admits "needs improvement," it is disgraceful that this flawed theory is being used under the Committee's baseless new standard to condemn Applicant's scientific evidence without fair consideration.

Once again, Applicant submits that his more advanced, modern theory not only invalidates quantum theory, but that his state-of-the-art experimental evidence conclusively demonstrates the fatal flaws inherent in that outdated theory. The evidence of record proves the existence of lower energy states and outdated quantum theory forbids these lower energy states. It is on that basis that quantum theory does not represent the real world and is thus invalid.

On page 10 of the Consolidated Appendix, the Committee further incorrectly states:

> While it is agreed that an inventor need not necessarily understand the theory behind his invention, attention is drawn to the fact that by reciting the phrases that include "hydrino atom" or equivalent terminology, such as, "hydrino hydride," "increased binding energy hydrogen species," etc. referring to something other than a "normal" hydrogen atom, in his claims, *the applicant has ipso facto introduced his theory of the "hydrino atom" into the claims.*

The problem with this statement is the Committee's continued refusal to face the

fact that, irrespective of Applicant's theory, or how he discovered lower energy states, he is entitled to have his experimental evidence fairly considered. It cannot be considered fair when the Committee's lead Examiner is the president of a company that competes with Applicant, who relies on an outdated theory that even he admits "needs improvement" to suggest that Applicant's "hydrino atom" is somehow "incredible," even after he has admitted that lower energy states are not impossible. No reasonable person would say that is fair.

Applicant's experimental evidence conclusively demonstrates the existence of lower energy states and the Committee has failed to show otherwise.

On page 10 of the Consolidated Appendix, the Committee further incorrectly states:

> Moreover, a similar interpretation of an invention occurred in *Newman v. Quigg, op. cit.,* where an applicant's claims to a machine which operated according to a theory which violated the second law of thermodynamics were held to be unpatentable. Hence it is clear why the examiner is obliged to review applicant's theory in addition, to evaluating the experimental evidence alleged to support patentability of the present claims.

This argument is a complete *non sequitor*, as it is ridiculous to compare Newman's device, which violated the second law of thermodynamics, to Applicant's technology, which is based on compliance with all physical laws. To date, the Committee has not identified a single law that has been violated in Applicant's case. In contrast, Applicant has shown how outdated quantum theory violates any number of physical laws. Thus, under the Committee's own standard, its entire analysis based on that flawed theory falls apart.

On page 10 of the Consolidated Appendix, the Committee further incorrectly states:

> The applicant's theory is the *unique* source from which the existence of the "hydrino atom" is demonstrated. It is, therefore, natural and logical to interpret applicant's invention in terms of the basic underlying premise offered by applicant's theory. Detailed analysis and discussion of applicant's theory and experimental results are found in the following sections of this appendix that show that the existence of the applicant's hydrino is theoretically impossible and not confirmed by experimental evidence.

Applicant agrees that he was the first to discover lower energy states and was the first to teach how to make and use these lower energy states. As discussed herein, the Committee has not provided even a single physical law that forbids these lower energy states. Instead, the Committee improperly relies upon flawed, outdated quantum theory as an excuse to ignore most of the experimental evidence of record.

On page 11 of the Consolidated Appendix, the Committee further incorrectly states:

> The examiner's principal position is that applicant has failed to scientifically substantiate the very existence of the "hydrino atom" let alone its many alleged manifestations in the experimental data provided by the applicant. It is noted that scientific research on the hydrogen atom extends over nearly a century. The relatively "simple" structure of the hydrogen atom, which consists of a single electron bound to a single nuclear proton *via* a Coulomb potential, has made it particularly amenable to investigation by the sophisticated techniques of modern science. The very detailed knowledge thus obtained about the properties of the hydrogen atom epitomizes the success of modern science.

Once again, the Committee resorts to drawing broad, general conclusions without fairly considering the evidence of record. Applicant agrees with the Committee that he was the first to discover lower energy states of hydrogen about 1989. Applicant found these lower energy states based on his modern theory that predicted them. In contrast, weird quantum theory absolutely forbids these lower energy states and, thus, it is not surprising that no one discovered how to form them until Applicant. This lack of knowledge of lower energy states proves the absolute novelty of Applicant's invention, nothing more.

On page 11 of the Consolidated Appendix, the Committee further incorrectly states:

> Experimental measurements of the energy states of the electron in a hydrogen atom are confirmed exactly by calculations based on a well-accepted theory known as quantum mechanics (or, formerly, wave mechanics). Quantum mechanics as accepted by the scientific community is referred to by applicant as standard quantum mechanics, SQM or QM throughout prosecution history. In contrast, applicant's theory is called classical quantum mechanics or CQM.

As discussed herein, outdated quantum theory does not exactly calculate all

energy states of the hydrogen atom. In fact, the Committee admits that quantum theory forbids the lower energy states now experimentally confirmed.

On page 11 of the Consolidated Appendix, the Committee further incorrectly states:

> Since its inception over a century ago, quantum mechanics has been progressively refined to the point that its credentials with respect to making highly accurate predictions are very well established. Despite certain *philosophical* conundrums, one of skill in the art would agree that, *in actual practice,* quantum mechanics makes highly successful predictions that clearly *do* stand up to experimental verification.

This statement has no factual support whatsoever. As shown by Applicant on numerous occasions, quantum theory is merely a curve fitting practice that has no predictive power. The Committee's unsupported conclusions to the contrary fail to rebut Applicant's showing that quantum theory, which the Committee admits "needs improvement," forbids lower energy states, and provide no basis for ignoring Applicant's state-of-the-art experimental evidence proving their existence.

On pages 11-12 of the Consolidated Appendix, the Committee further incorrectly states:

> As evidence to support this position, note the following quotations from state-of-the-art references:

> "One of the *simplest,* and *most completely treated,* fields of application of quantum mechanics is the theory of *atoms* with *one* or two *electrons.* For hydrogen and the analogous ions He~, ~ Li++, etc., the calculations can be performed *exactly,* both in *Schrodinger's nonrelativistic wave mechanics* and in Dirac's relativistic theory of the electron. More specifically, the calculations are exact for a single electron in fixed Coulomb potential Hydrogen-like atoms thus furnish an excellent way of testing the *validity of quantum mechanics."* Bethe and Salpeter (1977) on p. 2. [Footnote omitted.]

> "The energy formula (2.11) [i.e. B = - *(1/2) Z^2/n^2, n a positive integer,* representing the energy of the hydrogen atom and hydrogen-like ions having a single electron] has been *verified to an extraordinary degree by spectroscopic measurements."* Bethe and Salpeter on p. 9.

> "After applying corrections for fine structure, etc., *the agreement for a large number of spectral lines is excellent,* to better than one part in a million for

the H~ line, for instance. ... *Many spectral lines* have also been measured for hydrogen-like ions of higher nuclear charge Z, up to seven-times ionized oxygen *(Z = 8). The agreement is again excellent."* Bethe and Salpeter on p. 12.

These self-serving statements by Bethe and Salpeter carry very little weight. As clearly admitted by Bethe and Salpeter in these statements, outdated quantum theory is only valid for one-electron atoms, at energy states of $n=1$ and greater.

Quantum theory's boast of solving one-electron atoms pales in comparison to the predictive power of Applicant's modern theory. As discussed herein, Applicant's modern theory is accurate for all atoms, not just hydrogen, as well as molecules.

On page 12 of the Consolidated Appendix, the Committee further incorrectly states:

"At the present stage of human knowledge, *quantum mechanics can be regarded as the fundamental theory of atomic phenomena."* Schiff (1968) very first sentence on p. 1.

Applicant agrees that in 1968 when Schiff made this boast, quantum theory may have been "fundamental." However, in the present 21st century, state-of-the-art experimental evidence and Applicant's modern theory have progressed science far beyond the limitations of outdated quantum theory.

On page 12 of the Consolidated Appendix, the Committee further incorrectly states:

"Quantum theory is *the most precisely tested and most successful theory in the history of science."* Kleppner & Jackiw (2000) on p. 893.

In the Attachment, the Committee argues that quantum theory "needs improvement." A theory that admittedly needs improvement cannot hardly be referred to as the most successful theory ever. Applicant points out in detail the numerous flaws of outdated quantum theory in his paper:

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Annales de la Foundation Louis de Broglie, submitted.

Quantum mechanics (QM) and quantum electrodynamics (QED) are often touted as the most successful theories ever. In this paper, this

claim is critically evaluated by a test of internal consistency for the ability to calculate the conjugate observables of the nature of the free electron, ionization energy, elastic electron scattering, and the excited states of the helium atom using the same solution for each of the separate experimental measurements. It is found that in some cases quantum gives good numbers, but the solutions are meaningless numbers since each has no relationship to providing an accurate physical model. Rather, the goal is to mathematically reproduce an experimental or prior theoretical number using adjustable parameters including arbitrary wave functions in computer algorithms with precision that is often much greater (e.g. 8 significant figures greater) than possible based on the propagation of errors in the measured fundamental constants implicit in the physical problem. Given the constraints of adherence to physical laws and internal consistency, an extensive literature search indicates that quantum mechanics has never solved a single physical problem correctly including the hydrogen atom and the next member of the periodic chart, the helium atom. Rather than using postulated unverifiable theories that treat atomic particles as if they were not real, physical laws are now applied to the same problem. In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, a classical approach is explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level. The proverbial view deeply seated in the wave-particle duality notion that there is no large-scale physical counterpart to the nature of the electron is shown not to be correct. Physical laws and intuition may be restored when dealing with the wave equation and quantum atomic problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles as reported previously [1-6] that successfully applies physical laws to the solution of atomic problems that has its basis in a breakthrough in the understanding of the stability of the bound electron to radiation. Rather than using the postulated Schrödinger boundary condition: "$\Psi \rightarrow 0$ as $r \rightarrow \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$ - state electron cannot radiate energy.* Although it is well known that an accelerated *point* particle radiates, an *extended distribution* modeled as a superposition of accelerating charges does not have to radiate. A simple invariant physical model arises naturally wherein the predicted results are extremely straightforward and internally consistent requiring minimal math as in the case of the most famous equations of Newton, Maxwell, Einstein, de Broglie, and Planck on which the model is based. No new physics is needed; only the known physical laws based on direct observation are used. The accurate solution of the helium atom is confirmed by the agreement of predicted and observed conjugate parameters using the

same unique physical model in all cases.

The other fatal flaws of outdated quantum mechanics are shown in R. Mills, The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory.[2] Quantum electrodynamics permits perpetual motion of the first and second kinds and predicts an infinite cosmological constant, which conclusively proves that quantum electrodynamics does not represent reality and cannot properly be relied upon as a basis to reject Applicant's technology.

The success of quantum electrodynamics can be attributed to unlimited lack of rigor and abandonment to adherence to physical laws. This point has been peer-reviewed and published by Applicant, in R. Mills, The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096, which states:

> Throughout the history of quantum theory; wherever there was an advance to a new application, it was necessary to repeat a trial-and -error experimentation to find which method of calculation gave the right answers. Often the textbooks present only the successful procedure as if it followed from first principles; and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle to fit the empirically successful algorithm. For example, we know that it required a great deal of art and tact over decades of effort to get correct predictions out of Quantum Electrodynamics (QED). For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off the infinities) in one particular way and not in some other way that appears in principle equally valid. There is a corollary , noted by Kallen: from an inconsistent theory, any result may be derived. If internally consistency and adherence to physical laws are invoked, quantum mechanic has never successfully solved a physical problem.

Taking from R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition Chapter 1, pp. 99-101:

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[2] Reference 32.

The *postulated* QED theory of $\frac{g}{2}$ is based on the determination of the terms of a *postulated* power series in α/π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term. The algorithm involves scores of *postulated* Feynman diagrams corresponding to thousands of matrices with thousands of integrations per matrix requiring decades to reach a consensus on the "appropriate" *postulated* algorithm to remove the intrinsic infinities. The remarkable agreement between Eqs. (1.204) and (1.205) demonstrates that $\frac{g}{2}$ may be derived in closed form from Maxwell's equations in a simple straightforward manner that yields a result with eleven figure agreement with experiment—the limit of the experimental capability of the measurement of the fundamental constants that determine α. In Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality, the Maxwellian result is contrast with the QED algorithm of invoking virtual particles, zero point fluctuations of the vacuum, and negative energy states of the vacuum.

The muon, like the electron, is a lepton with $\hbar$ of angular momentum. The magnetic moment of the muon is given by Eq. (1.136) with the electron mass replaced by the muon mass. It is twice that from the gyromagnetic ratio as given by Eq. (2.36) of the Orbital and Spin Splitting section corresponding to the muon mass. As is the case with the electron, the magnetic moment of the muon is the sum of the component corresponding to the kinetic angular momentum, $\frac{\hbar}{2}$, and the component corresponding to the vector potential angular momentum, $\frac{\hbar}{2}$, (Eq. (1.132). The spin-flip transition can be considered as involving a magnetic moment of g times that of a Bohr magneton of the muon. The g factor is equivalent to that of the electron given by Eq. (1.196).

The muon anomalous magnetic moment has been measured in a new experiment at Brookhaven National Laboratory (BNL) [29]. Polarized muons were stored in a superferric ring, and the angular frequency difference ω_a between the spin precession and orbital frequencies was determined by measuring the time distribution of high-energy decay positrons. The dependence of ω_a on the magnetic and electric fields is given by BMT equation which is the relativistic equation of motion for spin in uniform or slowly varying external fields [30]. The dependence on the electric field is eliminated by storing muons with the "magic" $\gamma = 29.3$, which corresponds to a muon momentum $p = 3.09 \, GeV/c$. Hence

measurement of ω_a and of B determines the anomalous magnetic moment.

The "magic" γ wherein the contribution to the change of the longitudinal polarization by the electric quadrapole focusing fields are eliminated occurs when

$$\frac{g_\mu \beta}{2} - \frac{1}{\beta} = 0 \qquad (1.206)$$

where g_μ is the muon g factor which is required to be different from the electron g factor in the standard model due to the dependence of the mass dependent interaction of each lepton with vacuum polarizations due to virtual particles. For example, the muon is much heavier than the electron, and so high energy (short distance) effects due to strong and weak interactions are more important here [26]. The BNL Muon (g-2) Collaboration [29] used a "magic" $\gamma = 29.3$ which satisfied Eq. (1.206)

identically for $\frac{g_\mu}{2}$; however, their assumption that this condition eliminated the affect of the electrostatic field on ω_a is flawed as shown in Appendix III: Muon g Factor. Internal consistency was achieved during the determination of $\frac{g_\mu}{2}$ using the BMT equation with the flawed assumption

that $\frac{g_\mu}{2} \neq \frac{g_e}{2}$. The parameter measured by Carey et al. [29] corresponding

to $\frac{g_\mu}{2}$ was the sum of a finite electric term as well as a magnetic term. The calculated result based on the equivalence of the muon and electron g factors

$$\frac{g_\mu}{2} = 1.001\ 165\ 923 \qquad (1.207)$$

is in agreement with the result of Carey et al. [29]:

$$\frac{g_\mu}{2} = 1.001\ 165\ 925\ (15) \qquad (1.208)$$

Rather than indicating an expanded plethora of postulated super-symmetry virtual particles which make contributions such as smuon-neutralino and sneutrino-chargino loops as suggested by Brown et al. [31], the deviation of the experimental value of $\frac{g_\mu}{2}$ from that of the standard model prediction simply indicates that the muon g factor is identical to the

electron g factor.

Taking from R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition Appendix II: Quantum Electrodynamics (QED) is Purely Mathematical and Has No Basis in Reality:

Throughout the history of quantum theory; wherever there was an advance to a new application, it was necessary to repeat a trial-and -error experimentation to find which method of calculation gave the right answers. Often the textbooks present only the successful procedure as if it followed from first principles; and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle to fit the empirically successful algorithm. For example, we know that it required a great deal of art and tact over decades of effort to get correct predictions out of QED. The QED method of the determination of $(g-2)/2$ from the *postulated* Dirac equation is based on a *postulated* powers series of α/π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term which is processed over decades using ad hoc rules to remove infinities from each term that arises from *postulated* scores of *postulated* Feynman diagrams. Mohr and Taylor reference some of the Herculean efforts to arrive at g using QED [42]:

"the sixth-order coefficient $A_1^{(6)}$ arises from 72 diagrams and is also known analytically after nearly 30 years of effort by many researchers [see Roskies, Remiddi, and Levine (1990) for a review of the early work]. It was not until 1996 that the last remaining distinct diagrams were calculated analytically, thereby completing the theoretical expression for $A_1^{(6)}$".

For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off the infinities) in one particular way and not in some other way that appears in principle equally valid. For example, Milonni [43] presents a QED derivation of the magnetic moment of the electron which gives a result of the wrong sign and requires the introduction of an

"upper limit K in the integration over $k = \omega/c$ in order to avoid a divergence."

A differential mass is arbitrarily added, then

"the choice $K = 0.42mc/\hbar$ yields $(g-2)/2 = \alpha/2\pi$ which is the relativistic QED result to first order in α. [...] However, the reader is warned not to take these calculations too seriously, for the result $(g-2)/2 = \alpha/2\pi$ could be obtained by retaining only the first (radiation reaction) term in (3.112) and choosing $K = 3mc/8\hbar$. It should also be noted that the solution $K \cong 0.42mc/\hbar$ of (3.112) with $(g-2)/2 = \alpha/2\pi$ is not unique."

Such an ad hoc nonphysical approach makes incredulous:

" the cliché that QED is the best theory we have!" [44]

or the statement that:

"The history of quantum electrodynamics (QED) has been one of unblemished triumph" [45].

There is a corollary, noted by Kallen: from an inconsistent theory, any result may be derived.

The QED determination of the postulated power series in α/π is based on scores of Feynman diagrams corresponding to thousands of matrices with thousands of integrations per matrix requiring decades to reach a consensus on the "appropriate" algorithm to remove the intrinsic infinities. Remarkably, $(g-2)/2$ may be derived in closed form from Maxwell's equations in a simple straightforward manner that yields a result with eleven figure agreement with experiment—the limit of experimental capability. The derivation from first principles without invoking virtual particles, zero point fluctuations of the vacuum, and negative energy states of the vacuum is given in the Electron g Factor section.

Furthermore, Oskar Klein pointed out a glaring paradox implied by the Dirac equation which was never resolved [46]. "Electrons may penetrate an electrostatic barrier even when their kinetic energy, $E - mc^2$ is lower than the barrier. Since in Klein's example the barrier was infinitely broad this could not be associated with wave mechanical tunnel effect. It is truly a paradox: Electrons too slow to surpass the potential, may still only be partially reflected. ...Even for an infinitely high barrier, i.e. $r_2 = 1$ and energies $\approx 1\,MeV$, (the reflection coefficient) R is less than 75%! From (2) and (3) it appears that as soon as the barrier is sufficiently high: $V > 2mc^2$, electrons may transgress the repulsive wall-seemingly defying conservation of energy. ...Nor is it possible by way of the positive energy spectrum of the free electron to achieve complete Einstein causality."

The Rutherford experiment demonstrated that even atoms are

comprised of essentially empty space [47]. Zero-point field fluctuations, virtual particles, and states of negative energy and mass invoked to describe the vacuum are nonsensical and have no basis in reality since they have never been observed experimentally and would correspond to an essentially infinite cosmological constant throughout the entire universe including regions of no mass. As given by Waldrop [48], "What makes this problem into something more than metaphysics is that the cosmological constant is observationally zero to a very high degree of accuracy. And yet, ordinary quantum field theory predicts that it ought to be enormous, about 120 orders of magnitude larger than the best observational limit. Moreover, this prediction is almost inescapable because it is a straightforward application of the uncertainty principle, which in this case states that every quantum field contains a certain, irreducible amount of energy even in empty space. Electrons, photons, quarks—the quantum field of every particle contributes. And that energy is exactly equivalent to the kind of pressure described by the cosmological constant. The cosmological constant has accordingly been an embarrassment and a frustration to every physicist who has ever grappled with it."

Furthermore, a consequence of the Heisenberg Uncertainty principle and QED is that matter may be created from nothing, including vacuum. Taking quantum theory into account, Stephen Hawking [49-50] mathematically proved that blackholes must emit Hawking radiation comprising photons, neutrinos, and all sorts of massive particles. "The surface emits with equal probability all configurations of particles compatible with the observers limited knowledge. It is shown that the ignorance principle holds for quantum-mechanical evaporation of blackholes: The black hole creates particles in pairs, with one particle always falling into the hole and the other possibly escaping to infinity [50]." This QM theorem represents a perpetual motion machine with regard to spontaneous creation of mass and energy from the vacuum and with regard to gravitation. (QM also predicts a perpetual motion machine of the second kind [51-52]). Contrary to prediction, Hawking radiation has never been observed [53-55]. Classical laws including conservation of matter-energy are confirmed and QM is invalidated.

QED is further shown to be experimentally incorrect. Mobility measurements and spectroscopy directly show that electrons may be trapped in superfluid helium as autonomous electron bubbles interloped between helium atoms that have been excluded from the space occupied by the bubble. Electrons bubbles in superfluid helium reveal that the electron is real and that a physical interpretation of the wavefunction is necessary. The electron orbitsphere representation matches the data identically and is also in agreement with scattering experiments, another direct

determination of the nature of the electron.[3]

On page 12 of the Consolidated Appendix, the Committee further incorrectly states:

> "In short, the *experimental verdict is in: the weirdness of the quantum world is real, whether we like it or not."* Tegmark and Wheeler (2001) on p. 72.

This statement by Tegmark and Wheeler has no basis in reality and most certainly is not supported by real-world scientific evidence. Quantum theory is only "weird" because it does NOT represent the real world. In contrast, Applicant's modern theory is not weird precisely because it does represent the real world, as confirmed by the experimental evidence of record.

Furthermore, the Committee continues to cite Tegmark and Wheeler as stating:

> "The astonishing range of scientific and practical applications of quantum mechanics undergrids: today an estimated 30 percent of the U.S. gross national product is based on inventions made possible by quantum mechanics, from semiconductors in computer chips to lasers in compact-disc players, magnetic resonance imaging in hospitals, and much more."

These statements again show that Tegmark and Wheeler make ridiculously grandiose statements regarding quantum theory that have no basis in reality. It is true that technologies have been developed that are based on the phenomenon of quantization. But, it can not be said that these technologies would not exist if it were not for probability wave equations (i.e. the Schrodinger equation). This self grandeur of Wheeler is simply nonsense. According to Wheeler, not only technologies but also the existence of the entire universe is dependent on the human mind. In Wheeler's quantum mechanical view of reality, the existence of a computer, a CD player, or an MRI scanner relies upon the human mind to collapse the quantum wavefunction to make these objects real.[4] The Committee is advised to read the original transistor patent, in which case it will find that it contains NO MENTION OF QUANTUM MECHANICS. It is based purely on empirical material science.

The invention of the transistor was based on phenomenology. The invention of

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[3] Reference 32.

the transistor is covered in Proceedings of the IEEE "Special Issue on the Fiftieth Anniversary of the Transistor", Vol. 86, No. 1, January, (1998). At page 34-36, Shockley's Patent is printed. It is not based on quantum mechanics. It is an engineering description of an amplifier based on properties of semiconductor materials arranged in a particular fashion.

There is no solution of the Schrodinger equation used in solid state physics. The discipline advances empirically and quantum mechanical hand-waving is added after a discovery. Examples include the quantum and integral Hall effects. Then there is the stifling of technology by quantum mechanics. For example, theoreticians violently insisted that high temperature superconductivity could not be possible since it violated BCS theory (incidentally a Noble prize was awarded for the DISCOVERY of high temperature superconductivity and the phenomenon can still not be explained by quantum mechanics theory). The Committee should also note as stated by Weinstein in Section I of this report, that chemists have been impeded by quantum mechanics.

Then there is the laser. Stimulated emission started with Einstein as an additional term to empirically fit Planck's blackbody radiator curve. The laser is completely explained by Maxwell's equations using the mere empirical observation of quantized energy levels.

The invention of the laser was based more on classical physics applied to observed quantum phenomenon. The idea of stimulated emission originated in 1917 (ten years before the Schrodinger equation was postulated) when Einstein proposed that Planck's formula for blackbody radiation could be obtained from an ensemble of atoms with quantized energy levels that under went stimulated and as well as spontaneous emission.[5] This idea was used by Schawlow and Townes in an extension of classical microwave resonator cavity theory to propose the extension of MASER techniques to visible wavelengths.[6] Masers were originally described classically given the phenomenon of quantization—not by using the Schrodinger

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[4] Reference 53.

[5] Reference 66.

[6] Reference 67.

equation.

What is even more devastating to the Committee's argument is that the mere existence of the laser disproves quantum mechanics and the Heisenberg Uncertainty Principle as pointed out by Carver Meade, Gordon and Betty Moore Professor of Engineering and Applied Science at Caltech, Feynman's former student, colleague and collaborator, as well as Silicon Valley's physicist in residence and leading intellectual, who was recently interviewed on this subject:[7]

> Central to Mead's rescue project are a series of discoveries inconsistent with the prevailing conceptions of quantum mechanics. One was the laser. As late as 1956, Bohr and Von Neumann, the paragons of quantum theory, arrived at the Columbia laboratories of Charles Townes, who was in the process of describing his invention. With the transistor, the laser is one of the most important inventions of the twentieth century. Designed into every CD player and long distance telephone connection, lasers today are manufactured by the billions. At the heart of laser action is perfect alignment of the crests and troughs of myriad waves of light. Their location and momentum must be theoretically knowable. But this violates the holiest canon of Copenhagen theory: Heisenberg Uncertainty. Bohr and Von Neumann proved to be true believers in Heisenberg's rule. Both denied that the laser was possible. When Townes showed them one in operation, they retreated artfully.
>
> In Collective Electrodynamics, Mead cites nine other experimental discoveries, from superconductive currents to masers, to Bose-Einstein condensates predicted by Einstein but not demonstrated until 1995. These discoveries of large-scale, coherent quantum phenomena all occurred after Bohr's triumph over Einstein.

Magnetic resonance is also described by Maxwell's equations. In fact, in a recent communication, Applicant was informed by Dr. Samuel Patz who heads the MRI Laboratory at the Brigham & Women's Hospital, Harvard Medical School's top research center, that MRI is taught at Harvard and Massachusetts Institute of Technology as the classical precession of the bulk magnetization vector in a frame rotating at the Larmor frequency due to the application of an applied RF field at the Larmor frequency wherein the bulk magnetization is due to the phenomenon of nuclear spin direction

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[7] Reference 68.

quantization.[8] The Schrodinger equation is not used, and the quantum theory of the nucleus, quantum chromodynamics (QCD), is an utter failure in that it can not predict the existence of the proton and neutron or correctly account for the phenomenon of nuclear spin; whereas, Applicant's theory can. From first principles, Applicant's theory predicts the masses of the proton and neutron and their magnetic moments to within a part per hundred thousand of the observed values in closed form equations containing fundamental constants only.[9]

Simply put, quantum mechanics has failed. It can not explain the most fundamental observations such as the nature of a photon, the electron, the wave-particles duality nature of light and particles (See Section 14 of this Response), the masses of particles, gravity, etc. It has been a complete failure at unification.[10] The Committee has gone to great lengths to establish that Noble prizes have been award in the pursuit of quantum mechanics. The Committee has been diligent at pointing out celebrities of quantum physics. Notably absent from the list are Newton, Einstein, and Maxwell. It doesn't matter how many theoreticians toil at trying to make quantum mechanics work or what fantasies they will tolerate in order to force it to work if it is based on a *false premise*. That false premise is that physical laws such as Maxwell's equations and Newton's laws with Einstein's special relativity do not apply at the atomic level. Physicists have justified the spookiness and absurd consequences of quantum mechanics on the basis that no theory based on physical laws can explain quantum phenomena, such as quantized nature of light and atomic energy levels and the wave-particle duality. This is absolutely *not true* as shown by Applicant.[11] Classical laws work over 85 orders of magnitude of scale from that of elementary particles to that of the cosmos. Science is not a popularity contest, it is the endless search for the ultimate

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[8] Reference 69.

[9] Reference 39 at Proton and Neutron section.

[10] Reference 39, Forward and Introduction Sections.

[11] Reference 39.

truth of the workings of the physical universe established by empirical observation (I.E., ESTABLISHED BY DIRECT EXPERIMENTATION). Solipsistic nihilism and self grandeur have no place in science.

And, consider the impact on technology. We could live without quantum mechanics and only accept that empirical result that atomic energy levels are quantized. Quantum mechanics was not even adopted in any serious fashion until well after the seeds were sown for the major technologies cited by the Committee. In contrast, classical laws—Maxwell's equations and Newton's laws—which the Committee argues against by advocating the mutually incompatible quantum mechanics—are ABSOLUTELY INDISPENSABLE FOR MODERN SOCIETY. They are absolutely predictive; whereas, quantum mechanics is NOT.

In contrast to Quantum mechanics, which has never predicted a single technology, Applicant's theory has predicted novel hydrogen chemistry, which is now experimentally confirmed as summarized in Section I of this Response. The match between theoretical predictions and experimental observation are remarkable. Applicant's predicted technology could eclipse the value of those cited by the Committee and could in fact advance them significantly as shown in Applicant's published and soon-to-be published articles .[12]

On page 12 of the Consolidated Appendix, the Committee further incorrectly states:

> Unlike quantum mechanics, applicant's flawed theory of the hydrino atom is not accepted by the scientific community. Contrary to applicant's assertions in his response (see for example, page 126 in the response filed on 5/23/2005 in U.S. Serial No. 09/669,877), applicant's theory has not been accepted by the scientific community. At least as early as 1989, applicant's theory has been self published and made readily available to the scientific community through book vendors such as Amazon.com. To date, not one prestigious university in the United States teaches applicant's theory of the hydrino in their basic undergraduate science curriculum.

Once again, the Committee creates new standards to buttress its poorly crafted

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[12] References 2 and 3.

analysis. Applicant is unaware of any patent law or statute that requires a university to teach an invention before it will be eligible for patent protection. This nonsensical requirement by the Committee is frankly an embarrassment to the PTO.

Furthermore, Applicant has no doubt that even if he were to meet this inane standard, the Committee would simply fabricate new ones to advance its arbitrary "allowance is not an option" policy. Indeed, that is precisely what the Committee did in ignoring the numerous prestigious journals that peer-reviewed and published Applicant's experimental data in satisfaction of the previous requirements concocted by the Committee. Thus, even when Applicant satisfies such new evidentiary standards, the Committee simply invents new ones, like the requirement that Applicant's technology be taught by a "prestigious university." In doing so, however, the Committee further exposes its arbitrary and capricious approach to examination in this case.

On page 13 of the Consolidated Appendix, the Committee further incorrectly states:

> Mainstream physicists do not agree with applicant's theory (see for example, article by E. Baard, "Quantum Leap," The Village Voice, December 22-28, 1999; Cvetanovic et al., "Excessive Balmer line broadening in a plane cathode abnormal glow discharge in hydrogen," Journal of Applied Physics 97, 033302 (2005), pp. 033302-1 to 033302-8 (hereinafter referred to as Cvetanovic et al., J. Appl. Phys. (2005)); Jovicevic et al. "Excessive Balmer line broadening in microwave-induced discharges," Journal of Applied Physics 95, 24 (2004) (herein after referred to as Jovicevic et al., J. Appl. Phys. (2004); and A. Rathke, "A critical analysis of the hydrino model," New Journal of Physics 7 (2005) 127).

Here again, there is no patent law or statute that requires a competitor's agreement with an applicant's invention for it to be patentable. Instead of erroneously citing mere conjecture and outright fraud (Rathke) to support its ill-conceived position, the Committee would do better by focusing attention on Applicant's peer-reviewed experimental evidence, which to date has been largely ignored or marginalized on shaky grounds.

On page 13 of the Consolidated Appendix, the Committee further incorrectly states:

> Requiring acceptance of applicant's theory (which is the foundation

of his invention) by the scientific community is not improper for patentability as alleged by applicant in his response (see page 126 in the response filed on 5/23/2005 in U.S. Serial No. 09/669,877). If a theory is inconsistent with known scientific principles or that it is incredible in view of contemporary knowledge, utility rejection of the claims which is based on the theory would be appropriate according to MPEP § 2107.01 and § 2107.02.

Other cases suggest that on initial evaluation, the Office considered the asserted utility to be inconsistent with known scientific principles or "speculative at best" as to whether attributes of the invention necessary to impart the asserted utility were actually present in the invention. *In n Sichert,* 566 F.2d 1154, 196 USPQ 209 (CCPA 1977). However cast, the underlying finding by the court in these cases was that, based on the factual record of the case, it was clear that the invention could not and did not work as the inventor claimed it did.

MPEP § 2107.02 also states:

One situation where an assertion of utility would not be considered credible is where a person of ordinary skill would consider the assertion to be "incredible in view of contemporary knowledge" and where nothing offered by the applicant would counter what contemporary knowledge might otherwise suggest.

The Examiner considers applicant's asserted utility of the hydrino atom not to be credible where a person of ordinary skill in the art would consider the assertion to be "incredible in view of contemporary knowledge" of the electronic structure of the hydrogen atom. The contemporary knowledge of the energy levels of the hydrogen atom is that given by quantum mechanics which has been accepted by the scientific community.

The Examiner's analysis did not start with a presumption of "incredible utility" under 35 U.S.C. 101 as alleged by applicant (see page 2 of applicant's present response filed on 5/23/2005 in U.S. Serial No. 09/669,877) but instead the Examiner has provided substantial evidentiary basis for that assertion of "incredible utility" in previous appendices which have been incorporated into the present consolidated appendix.

These grounds of rejection go right to the heart of the Committee's erroneous analysis. One of the many problems lies in the fact that the Committee has elevated outdated quantum theory, which is known to be seriously flawed, to the status of "scientific principle" and compounded that gross error by then branding Applicant's

invention as "incredible." Even the Committee itself, led by Examiner (and current BMS President) Souw, has recognized this gross error by having admitted that quantum theory "needs improvement" and that the existence of lower-energy hydrogen is <u>not</u> impossible. [See attached Appendix.]

Applicant does not dispute that his modern theory is inconsistent with that outdated, flawed quantum theory to the extent that it forbids the formation of lower-energy states of hydrogen, and that fact has no bearing whatsoever on the utility of Applicant's claimed invention. Applicant's modern theory fully supports these novel lower-energy states and Applicant has real-world scientific evidence to back him up in the form of 65 peer-reviewed journal articles. The Committee, however, has largely ignored this overwhelming evidence that it previously admitted was credible, in favor of evidence that is infected by outright fraud (Dr. Rathke) and other assorted misrepresentations of Applicant's theory.

The Committee's stubborn refusal to recognize that flawed, outdated quantum theory does not represent the real world, as recognized by the scientific community, is a fundamental error. The Committee merely compounds that error by bootstrapping that flawed theory into a "scientific principle" to justify ignoring most of the scientific evidence of record.

Applicant finds it ironic that the Committee cites the following passage from MPEP § 2107.01: "However cast, the underlying finding by the court in these cases was that, <u>based on the factual record of the case</u>, it was clear that the invention could not and did not work as the inventor claimed it did." [Emphasis added.] The fact is that the Committee, led by the conflicted Examiner and BMS President Souw, has ignored much of the factual record in this case, including Applicant's scientific evidence, which demonstrably proves that his invention does work precisely as claimed.

Regarding the Committee's citation to MPEP § 2107.02, Applicant also finds it incredibly odd that the Committee quotes but a single sentence, which, in fact, destroys its entire position, and that it conveniently fails to quote the even more damaging remainder of the paragraph from which that sentence was taken. The sentence quoted by the Committee states:

> One situation where an assertion of utility would not be considered

credible is where a person of ordinary skill would consider the assertion to be "incredible in view of contemporary knowledge" <u>and where nothing offered by the applicant would counter what contemporary knowledge might otherwise suggest</u>. [Emphasis added.]

That statement does not support the Committee's position, but rather, makes the case for Applicant. Repeating the previous point, where "contemporary knowledge" is seriously flawed—even by Dr. Souw's own admission (see Appendix)—there is simply no basis for claiming that Applicant's invention is "incredible." In addition, the Committee conveniently ignores the remainder of its own quoted sentence that says: "<u>and</u> where nothing offered by the applicant would counter what contemporary knowledge might otherwise suggest." This is where the Committee's analysis completely falls apart, as Applicant has offered a <u>mountain</u> of evidence that counters this "contemporary knowledge." The Committee has simply chosen to ignore that evidence.

Likewise the Committee ignores the remainder of the paragraph from which the above sentence was taken, which states:

> Office personnel should be careful, however, not to label certain types of inventions as "incredible" or "speculative" as such labels do not provide the correct focus for the evaluation of an assertion of utility. "Incredible utility" is a conclusion, not a starting point for analysis under 35 U.S.C. 101. A conclusion that an asserted utility is incredible can be reached <u>only after the Office has evaluated both the assertion of applicant regarding utility and any evidentiary basis of that assertion</u>. The Office should be particularly careful not to start with a presumption that an asserted utility is, *per se,* "incredible" and then proceed to base a rejection under 35 U.S.C. 101 on that presumption. [Emphasis added.]

The Committee has utterly failed to follow the PTO's own prescription on how to conduct a proper utility analysis. The Committee is duty bound to consider <u>all</u> of the evidence Applicant has submitted to support his claim of utility, and having failed to do so, it has yet to even make out a *prima facie* case of non-utility. As detailed above, the Committee has flagrantly boasted about ignoring that evidence, for instance, by claiming that much of Applicant's evidence "detracts" from the central point that lower-energy hydrogen cannot possibly exist.

Regarding the Committee's other misplaced arguments, the fact remains that

Applicant's theory has achieved acceptance in the scientific community despite the fact that is not the proper standard for patentability. Indeed, acceptance by the scientific community was the basis for the Committee's insistence that Applicant's evidence did not have the "credibility that peer-reviewed articles have" before, of course, that evidence was published. Forced to backpedal once again, the Committee simply mints a new, vague standard to avoid having to fairly consider that evidence, now claiming that the journals that published those peer-reviewed articles were not "mainstream." These and other unfair standards invoked by the Committee do not even come close to satisfying the procedural requirements for accessing utility as provided in the MPEP sections it has cited.

On page 14 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant's hydrino or one electron hydrino-like atoms having an atomic mass of at least four are wholly inconsistent with contemporary knowledge in the art of atomic physics governed by quantum mechanics. Applicant's theory of the hydrogen atom is contrary to quantum mechanics which has been accepted by the scientific community. Applicant is advocating a new form of the hydrogen atom or a new form of one electron atoms called the hydrino or hydrino-like atoms respectively which have no valid scientific basis.

Once again, Applicant fully agrees that his pioneering invention is novel as it was not previously recognized by outdated quantum theory. Applicant further agrees that quantum theory forbids the existence of lower-energy hydrogen. That flawed theory, however, cannot properly be used by the Committee to ignore the extensive real-world experimental evidence of record showing that lower-energy hydrogen does in fact exist. Thus, contrary to the Committee's statements, there most certainly is a valid scientific basis for Applicant's hydrino atom.

On page 15 of the Consolidated Appendix, the Committee further incorrectly states:

> If applicant's novel theory of the hydrogen atom has been accepted by the scientific community as alleged by applicant, then quantum mechanics would not have been offered as an entire course in any reputable university since quantum mechanics directly contradicts applicant's theory of the hydrogen atom.

These statements have no merit whatsoever as already explained above.   In addition, the Committee's argument makes absolutely no sense and has no basis in patent law. The fact that outdated quantum theory is taught in a cult-like fashion has nothing to do with the patentability of Applicant's invention. At one time in history, professors no doubt taught that the world was flat in a manner similar to the way outdated quantum theory is now taught. It is an embarrassment to the PTO that the Committee continues to turn a blind eye to Applicant's real-world experimental evidence, while it desperately clings to failed quantum theory.

On page 15 of the Consolidated Appendix, the Committee further incorrectly states:

> Acceptance of applicant's theory would overturn 100 years of quantum mechanics. Nevertheless, since applicant's theory is mathematically and scientifically flawed, it is incapable of disproving quantum mechanics contrary to applicant's assertions of record.

As Applicant has shown throughout the prosecution of this case, it is outdated quantum theory, not Applicant's theory, that is mathematically and scientifically flawed, despite what the Committee led by the conflicted Examiner and BMS President Souw has to say on the subject. The Committee's reliance on the tainted views of Dr. Souw and Dr. Rathke does not even come close to rebutting and overcoming the significant weight of the evidence presented by Applicant in this case. Applicant agrees that he has overturned 100 years of a flawed theory of quantum mechanics. For that he should be lionized, not demonized. Outdated quantum theory has cost the U.S. countless billions of dollars in wasted government research and prevented technological advancement in many fields of science. It is disappointing to say the least that the U.S. Patent Office, created to encourage such technological advancement, continues to block the progress of science with its arbitrary policies and standards.

On page 15 of the Consolidated Appendix, the Committee further incorrectly states:

> As evidence of acceptance of quantum mechanics by the scientific community, quantum mechanics is still taught in prestigious universities today. McQuarrie (U). McQuarrie. Quantum Chemistry. Sausalito, California: University Science Books, 1983), a reference cited and used by

applicant to support his arguments of record, and Karplus and Porter (M. Karplus and R. Porter. <u>Atoms and Molecules: An Introduction for Students of Physical Chemistry</u>. Reading, Massachusetts: W.A. Benjamin, Inc., 1970) are two exemplary standard physical chemistry textbooks still in use in many undergraduate science curriculums in the United States. The textbooks do not recognize fractional quantum number energy states for the hydrogen atom or for the one electron hydrogen like atoms and instead recognize only integer quantum number energy states for the hydrogen atom and for the one-electron hydrogen like atoms where principal quantum number ii is 1, 2, 3, etc. (see pages 118-122 of Karplus and Porter and pages 221-222 of McQuarrie).

These statements prove nothing and are but further examples of the impotent arguments advanced by the Committee. Libraries are filled with old textbooks that teach outdated views. The fact that Applicant has over 60 peer-reviewed articles relating to lower-energy hydrogen shows a distinct shift towards Applicant's theory. The scientific data presented in these articles establishes real-world evidence of the lower-energy states of hydrogen and justifies abandoning weird quantum theory that advocates a fictional world of multiple dimensions. History will not be kind to the PTO and the Committee for its hostile and reckless attacks against this Applicant.

On page 15 of the Consolidated Appendix, the Committee further incorrectly states:

> In fact, Karplus and Porter also states on page 3 that:
>
> "Newton's laws do not apply to electrons in atoms and a set of taws, comprising what is known as quantum mechanics, has to be obtained for a correct description of electronic behavior."

The Committee's reliance on Karplus and Porter is not well placed. As stated previously by Applicant, according to outdated quantum theory textbooks, which the Committee relies upon so heavily, <u>the electron is in the nucleus</u>. The conventional theory of the hydrogen atom can not be correct if it requires that the electron is in the nucleus. Thus, SQM has again been shown to be fatally flawed as discussed in Ref. # 17 and 80.

The Committee exposes a gaping hole in its entire analysis by failing to recognize that a valid theory can not permit the electron to "spiral into the nucleus". An

inescapable fact of SQM is that the wave function solution of the SE requires that **the electron is in the nucleus** [17, 80]. In fact, the electron must exist in the nucleus since the wave function is a maximum there. **This is clearly claimed in the literature as discussed by Karplus to explain the spin-nuclear coupling called Fermi contact interaction for example** [M. Karplus and R. N. Porter, *Atoms and Molecules an Introduction for Students of Physical Chemistry*, The Benjamin/Cummings Publishing Company, Menlo Park, California, (1970), p. 567]. The Committee's continued failure to address and recognize this point is most telling.

The Committee's repeated citation to Karplus and Porter only serves to further demonstrate the many flaws of outdated quantum theory and certainly does not rebut Applicant's real-world scientific evidence of record. Again, Karplus and Porter's alleged "correct description of electronic behavior" requires that the electron be in the nucleus, which is clearly wrong. Thus, the Committee's continued reliance upon the absurd positions by Karplus and Porter simply cannot stand.

On pages 15-16 of the Consolidated Appendix, the Committee further incorrectly states:

> The Examiner also checked the Massachusetts Institute of Technology's (MIT's) Opencourseware Website which confirms that the theory of the hydrogen atom based on quantum mechanics has not been changed for the undergraduate curriculum and applicant's theory is not taught in MIT's online course material. MIT's OpenCourseware website under the chemistry link lists the following course material, Introductory Quantum mechanics II, Spring 2005, as being available online (see attached Chemistry Course Listings in MIT OpenCourseWare. [online]. Massachusetts Institute of Technology, 2005. [retrieved on 2005-09-16]. Retrieved from the Internet: <URL: http://ocw.mit.edu/OcwWeb/Chemistry/indcxhtrn>).
>
> MIT OpenCourseWare is a free, open publication of MIT Course Materials and the website allows the public to view and download all the course material online (see Welcome to MIT's OpenCourseWare Home Page. [online]. Massachusetts Institute of Technology, 2005 [retrieved on 2005-09-16]. Retrieved from the Internet: CURL: http://ocw.mit.edu/index.html >).
>
> As seen in the chemistry section of the website, courses material in quantum mechanics are openly available to the public at this time. The course listing online provides evidence that a prestigious institution like

MIT has not rejected quantum mechanics otherwise it would not offer online course material on quantum mechanics to the public as of September 2005 and would not have devoted an entire graduate level course in quantum mechanics in Spring 2005.

Once again, the Committee's arguments fall flat. Just because universities teach the flawed theory of quantum mechanics in a cult-like fashion has no bearing on whether the underlying theory is right or wrong. This absurd requirement that a patentee must have his invention taught at a university has no basis in law and merely exposes the weakness of the Committee's arguments.

On page 16 of the Consolidated Appendix, the Committee further incorrectly states:

As further evidence of the acceptance of quantum mechanics to determine the energy levels of the hydrogen atom, the National Institute of Standards and Technology's (NIST's) website provides access to a database which calculates theoretical values of energy levels of hydrogen for principal quantum number n 1 to 200. To date, this database does not recognize fractional quantum integers ii for the energy levels of hydrogen atom (see NIST's Physical Reference Datasheet, "Energy Levels of Hydrogen and Deuterium" [online]. [retrieved on 2005-09-12]. Retrieved from the Internet: C URL: http://physics.nist.gov/PhysRefData/HDEL/index.html>.

Most important, NIST's database recognizes the ground state of the hydrogen atom to be at $n = 1$.

These statements are truly incredible. For over a decade, NIST has had an open invitation to test Applicant's lower-energy technology, but has refused to conduct such tests. In light of that refusal, it is no surprise that Applicant's data cannot be found on NIST's website. It is absurd for the Committee to now suggest that NIST would place data on its website for experiments that it did not conduct. The fact that NIST makes no comment on lower-energy hydrogen is totally irrelevant and that the Committee would even bring the matter up says more about the weakness of its own position than it does about Applicant's.

On page 17 of the Consolidated Appendix, the Committee further incorrectly states:

Contrary to applicant's assertion that quantum mechanics is

nonsense and has not produced anything useful (see for example, pp.133-141 of applicant's response filed on 5/23/2005 in U.S. Serial No. 09/669,877), many technological advances enjoyed by society today are direct applications of quantum mechanics (see Tegmark and Wheeler (2001)).

As previously discussed herein, Tegmark and Wheeler make ridiculously grandiose statements regarding quantum theory that have no basis in reality. It is true that technologies have been developed that are based on the phenomenon of quantization. But, it can not be said that these technologies would not exist if it were not for probability wave equations (i.e. the Schrodinger equation). This self grandeur of Wheeler is simply nonsense. According to Wheeler, not only technologies but also the existence of the entire universe is dependent on the human mind, which is absurd. In Wheeler's quantum mechanical view of reality, the existence of a computer, a CD player, or an MRI scanner relies upon the human mind to collapse the quantum wavefunction to make these objects real.[13] The Committee is advised to read the original transistor patent, in which case it will find that it contains NO MENTION OF QUANTUM MECHANICS. It is based purely on empirical material science.

The invention of the transistor was based on phenomenology. The invention of the transistor is covered in Proceedings of the IEEE "Special Issue on the Fiftieth Anniversary of the Transistor", Vol. 86, No. 1, January, (1998). At page 34-36, Shockley's Patent is printed. It is not based on quantum mechanics. It is an engineering description of an amplifier based on properties of semiconductor materials arranged in a particular fashion.

There is no solution of the Schrodinger equation used in solid state physics. The discipline advances empirically and quantum mechanical hand-waving is added after a discovery. Examples include the quantum and integral Hall effects. Then there is the stifling of technology by quantum mechanics. For example, theoreticians violently insisted that high temperature superconductivity could not be possible since it violated BCS theory (incidentally a Noble prize was awarded for the DISCOVERY of high temperature superconductivity and the phenomenon can still not be explained by

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quantum mechanics theory). The Committee should also note as stated by Weinstein in Section I of this report, that chemists have been impeded by quantum mechanics.

Then there is the laser. Stimulated emission started with Einstein as an additional term to empirically fit Planck's blackbody radiator curve. The laser is completely explained by Maxwell's equations using the mere empirical observation of quantized energy levels.

The invention of the laser was based more on classical physics applied to observed quantum phenomenon. The idea of stimulated emission originated in 1917 (ten years before the Schrodinger equation was postulated) when Einstein proposed that Planck's formula for blackbody radiation could be obtained from an ensemble of atoms with quantized energy levels that under went stimulated and as well as spontaneous emission.[14] This idea was used by Schawlow and Townes in an extension of classical microwave resonator cavity theory to propose the extension of MASER techniques to visible wavelengths.[15] Masers were originally described classically given the phenomenon of quantization—not by using the Schrodinger equation.

What is even more devastating to the Committee's argument is that the mere existence of the laser disproves quantum mechanics and the Heisenberg Uncertainty Principle as pointed out by Carver Meade, Gordon and Betty Moore Professor of Engineering and Applied Science at Caltech, Feynman's former student, colleague and collaborator, as well as Silicon Valley's physicist in residence and leading intellectual, who was recently interviewed on this subject:[16]

> Central to Mead's rescue project are a series of discoveries inconsistent
> with the prevailing conceptions of quantum mechanics. One was the
> laser. As late as 1956, Bohr and Von Neumann, the paragons of quantum
> theory, arrived at the Columbia laboratories of Charles Townes, who was
> in the process of describing his invention. With the transistor, the laser is
> one of the most important inventions of the twentieth century. Designed

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[14] Reference 66.

[15] Reference 67.

[16] Reference 68.

into every CD player and long distance telephone connection, lasers today are manufactured by the billions. At the heart of laser action is perfect alignment of the crests and troughs of myriad waves of light. Their location and momentum must be theoretically knowable. But this violates the holiest canon of Copenhagen theory: Heisenberg Uncertainty. Bohr and Von Neumann proved to be true believers in Heisenberg's rule. Both denied that the laser was possible. When Townes showed them one in operation, they retreated artfully.

In Collective Electrodynamics, Mead cites nine other experimental discoveries, from superconductive currents to masers, to Bose-Einstein condensates predicted by Einstein but not demonstrated until 1995. These discoveries of large-scale, coherent quantum phenomena all occurred after Bohr's triumph over Einstein.

Magnetic resonance is also described by Maxwell's equations. In fact, in a recent communication, Applicant was informed by Dr. Samuel Patz who heads the MRI Laboratory at the Brigham & Women's Hospital, Harvard Medical School's top research center, that MRI is taught at Harvard and Massachusetts Institute of Technology as the classical precession of the bulk magnetization vector in a frame rotating at the Larmor frequency due to the application of an applied RF field at the Larmor frequency wherein the bulk magnetization is due to the phenomenon of nuclear spin direction quantization.[17] The Schrodinger equation is not used, and the quantum theory of the nucleus, quantum chromodynamics (QCD), is an utter failure in that it can not predict the existence of the proton and neutron or correctly account for the phenomenon of nuclear spin; whereas, Applicant's theory can. From first principles, Applicant's theory predicts the masses of the proton and neutron and their magnetic moments to within a part per hundred thousand of the observed values in closed form equations containing fundamental constants only.[18]

Simply put, quantum mechanics has failed. It can not explain the most fundamental observations such as the nature of a photon, the electron, the wave-particles duality nature of light and particles (See Section 14 of this Response), the

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[17] Reference 69.

[18] Reference 39 at Proton and Neutron section.

masses of particles, gravity, etc. It has been a complete failure at unification.[19] The Committee has gone to great lengths to establish that Noble prizes have been award in the pursuit of quantum mechanics. The Committee has been diligent at pointing out celebrities of quantum physics. Notably absent from the list are Newton, Einstein, and Maxwell. It doesn't matter how many theoreticians toil at trying to make quantum mechanics work or what fantasies they will tolerate in order to force it to work if it is based on a *false premise*. That false premise is that physical laws such as Maxwell's equations and Newton's laws with Einstein's special relativity do not apply at the atomic level. Physicists have justified the spookiness and absurd consequences of quantum mechanics on the basis that no theory based on physical laws can explain quantum phenomena, such as quantized nature of light and atomic energy levels and the wave-particle duality. This is absolutely *not true* as shown by Applicant.[20] Classical laws work over 85 orders of magnitude of scale from that of elementary particles to that of the cosmos. Science is not a popularity contest, it is the endless search for the ultimate truth of the workings of the physical universe established by empirical observation (I.E., ESTABLISHED BY DIRECT EXPERIMENTATION). Solipsistic nihilism and self grandeur have no place in science.

And, consider the impact on technology. We could live without quantum mechanics and only accept that empirical result that atomic energy levels are quantized. Quantum mechanics was not even adopted in any serious fashion until well after the seeds were sown for the major technologies cited by the Committee. In contrast, classical laws—Maxwell's equations and Newton's laws—which the Committee argues against by advocating the mutually incompatible quantum mechanics—are ABSOLUTELY INDISPENSABLE FOR MODERN SOCIETY. They are absolutely predictive; whereas, quantum mechanics is NOT.

In contrast to Quantum mechanics, which has never predicted a single technology, Applicant's theory has predicted novel hydrogen chemistry, which is now

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[19] Reference 39, Forward and Introduction Sections.

[20] Reference 39.

experimentally confirmed as summarized in Section I of this Response. The match between theoretical predictions and experimental observation are remarkable. Applicant's predicted technology could eclipse the value of those cited by the Committee and could in fact advance them significantly as shown in Applicant's published and soon-to-be published articles .[21]

On page 17 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant asserts that his theory of the hydrino atom is accepted by the scientific community because he has many publications in major scientific journals. Although applicant has published in various journals, most of the journals in which applicant has published are not mainstream journals in the field of atomic physics to which the instant application pertains.

Applicant hardly knows where to begin with these statements that again erect new standards of patentability on top of previously contrived standards. Suffice it to say that the Committee cites no legal support for its classification of journals into "mainstream" and "non-mainstream" categories. Most reputable scientific journals require exhaustive peer-review before publication. Instead of attacking the status of the journals publishing Applicant's evidence, the Committee would be wise to start fairly evaluating his experimental data that it required him to publish in those journals. The Committee's refusal to do so based on a newly concocted standard attacking the status of these journals is embarrassing for a governmental agency charged with advancing the bounds of science.

On page 17 of the Consolidated Appendix, the Committee further incorrectly states:

> It is noted that applicant's only publication in the Journal of Applied Physics (Mills et al., J. Appl. Phys. 92, 7008 (2002)), which is a mainstream journal relevant to the field of atomic physics, makes no reference to the hydrino theory but only presents applicant's plasma results. The publication of applicant's article in the journal of Applied Physics merely gives the scientific community access to applicant's experimental results for scientific debate and scrutiny.

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[21] References 2 and 3.

This argument is further evidence of the Committee's arbitrary and capricious approach to examining Applicant's evidence. First, the Committee unfairly requires that Applicant publish his experimental data before the PTO will consider it. Then, when Applicant complies, the Committee simply ignores its own standard and prior admission that peer-reviewed journal articles constitute credible evidence, and instead, asserts that the "scientific community" is the one responsible for considering Applicant's experimental data, not the PTO. That argument would be laughable if the consequences of the Committee's action were not so serious.

On page 17 of the Consolidated Appendix, the Committee further incorrectly states:

> It is noted that a plasma group (Cvetanovic et al., "Excessive Balmer line broadening in a plane cathode abnormal glow discharge in hydrogen," journal of Applied Physics 97, 033302 (2005), pp. 033302-1 to 033302-8, hereinafter referred to as Cvetanovic et al., J. Appl. Phys. (2005)) also published an article in the journal of Applied Physics which expressed disagreement with applicant's interpretation of his own plasma results published in the Journal of Applied Physics in 2002.

Cvetanovic has already been fully addressed by Applicant, without an adequate response from the Committee. As previously stated, Applicant finds the Committee's views on this article extremely troubling, though hardly surprising, since it appears to be a thinly veiled hatchet-job intended to discredit Applicant. Cvetanovic et. al. propose that the energy required to selectively heat atomic hydrogen to extraordinary temperatures comes from the field acceleration of ionic species. The paper **J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted** demonstrates that no model of that type is viable. Broadening existed throughout the plasma, and not only in the region of high fields. In fact, it was found that the nature of the broadening does not correlate to field strength whatsoever. All predictions that orientation of the observer relative to the field will impact the nature of the observed broadening were disproved. For example, observation parallel to the field should yield broad lines that are red or blue shifted, and not symmetric, as a function of the orientation of the observer relative to the cathode. The results were always

symmetrical. Also, there is every reason to suggest that the magnitude of the broadening observed perpendicular to the direction of the field should be less than that parallel to the field. It was independent of the viewing direction. Philips et al. provide a data set, remarkably thorough relative to that of previously published work, that shows the shape of the Balmer lines perpendicular to the field, parallel to the field and in regions with no field are remarkably similar under many conditions. This data also makes all forms of the "field acceleration" models of broadening untenable.

The Cvetanovic article contains some data consistent with the statements made above. For example, in Figure 4 of that article there is data that shows that the broadening of the Ha peak is independent of the orientation of observation relative to the field direction.

Unfortunately, although the data agrees with that collected and reported by Philips et al., the text of the article contains some clear misrepresentations. Specifically, the data regarding the fit of Figure 4c (but notably not that of Figures 4a and 4b) is missing. It also appears to the careful reader that Fig. 4c was printed in a larger format than Figures 4a and 4b, and hence gives the appearance to the casual reader that the broadening in Figure 4c is larger than that of figures 4a and 4b. In fact, the broadening of Figure 4c is virtually identical to that measured for Figures 4a and 4b.

Perhaps the authors of the aforementioned paper did not want readers to have direct access to the data. Indeed, the data contradicts statements made in the Abstract:

> Large excessive Balmer alpha line broadening in pure hydrogen and its dependence upon the direction of observation with respect to the electric field is in contradiction to the resonance transfer model, proposed by Mills et al. in several publications (see, e.g., IEEE Trans. Plasma Sci. 31, 338 2003.)

Putting such a statement in the Abstract is a clear indication of the intent of the authors, i.e. to disprove the RT model despite the data to the contrary. Indeed, since the data they present shows that there is no dependence of line broadening upon the direction of observation with respect to the electric fields, the above statement in the abstract is false. The attack on Applicant's paper thus has the appearance of malice.

The sense of malicious mischief is increased because of additional directly false statements, such as this one from the conclusions:

> The presence of large excessive Ha line broadening in
> pure hydrogen and several experimental results, such as the
> importance of the direction of observation with respect to the
> electric field and exponential decay of excessive broadened
> Balmer line intensity in the negative glow, are in contradiction
> to the resonance transfer model.5,6

Not only is the data contained in the paper in direct contradiction to the statement regarding "direction of observation", there is in fact not a shred of data presented that refutes any of the predictions of CQM. It is unfortunate that these statements were even published, but then to be touted by the Committee is outrageous.

On pages 18-19 of the Consolidated Appendix, the Committee further incorrectly states:

> The applicant's position, as stated in his amendment (p. 53), is that
> "classical physical laws describe reality on *all* scales." Emphasis added.
> The conventional meaning of "classical" is that it refers to nonquantum or
> nonrelativistic physics such as it stood in the 19th century or about a
> hundred years ago.

> It is the examiner's position that one of skill in the art would find
> applicant's viewpoint that a *classical* theory can be applied to study
> *quantum* phenomena at the microscopic level, such as the behavior of
> electrons in atoms, to be *fundamentally erroneous.*

> As evidence, the examiner draws attention to Tolman (1979), pp. 180-
> 188, who, in a concise and masterly exposition of the elements of
> quantum mechanics, describes how and why *the necessity for modifying
> classical ideas* arose in the beginning of the 20th century. Quoting Tolman:

> > "The other of the two difficulties for nineteenth-century
> > physics was that of explaining the failure of electromagnetic
> > energy to distribute itself uniformly over all the possible
> > modes of vibration in an enclosure containing radiation
> > which has come to thermal equilibrium. *A reasonably
> > satisfactory solution of this problem, and of others which
> > proved to be associated with it, has only been made possible
> > by a criticism of the very nature of physical observation, with
> > a resulting appreciation of the uncontrolled character of the
> > effects that measurement itself must produce on systems —
> > particularly microscopic ones — when under observation.
> > Our present system of quantum mechanics must be
> > regarded as the ultimate outcome of such criticism."* See pp.

180-181.

And, further:

> "This new idea, that *atoms are characterized by sets of discrete energy levels* so that radiation can be absorbed and emitted in definite quanta, is the feature of the new developments which has led to the name *quantum mechanics. Its introduction marks a considerable step <u>away</u> from classical ideas* since there was *nothing in the classical picture* of an electric oscillator or of a planetary atom which would lead us to *expect that unique properties should be assigned to any particular energy levels chosen out of all the possible ones."* Emphasis added. See p. 182.

> The examiner has provided the motivation, based on the statements of those of skill in the art or experts in atomic theory, to back up his contention that a classical approach to studying atoms <u>*cannot*</u> supplant quantum mechanics <u>*if a truly accurate*</u> *understanding* of the properties of *atoms* is to be attained.

Tolman does not even make sense, suggesting that "the uncontrolled character of the effects that measurement itself must produce on system-particularly microscopic ones-under observation" is the basis of establishing thermal equilibrium. If this were the case, the only blackbodies throughout the universe would be those "under constant observation" by man. In contrast, statistical thermodynamics is based on classical physical laws as shown in Chp 15 of Mills GUT. Here, the mathematical and physical nonsense of performing statistics on a single atomic particle such as an electron is also discussed.

The discrete energy levels of all 110 NIST levels of helium are predicted classically in closed-form equations containing fundamental constants only using Applicant's modern theory. The physics of the classical excitation of resonator cavity modes is given in Mills' Gut Chp 9 and Mills paper:

R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

These results cannot be matched by outdated quantum after over 80 years of attempts.

On page 19 of the Consolidated Appendix, the Committee further incorrectly states:

See also Karplus and Porter (1970) which states on page 3 that:

"Newton's laws do not apply to electrons in atoms and a set of laws, comprising what is known as quantum mechanics, has to be obtained for a correct description of electronic behavior."

Karplus and Porter are obviously wrong since Applicant has shown that his modern theory, which is based on classical laws, does in fact solve hundreds of problems in exact equations that cannot be matched by outdated quantum theory, as given in Mills GUT and the following papers:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to

Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

The Committee has yet to refute this evidence.

On pages 19-20 of the Consolidated Appendix, the Committee further incorrectly states:

> With regard to quantum mechanics, Feynman et al. (1965) on p. 1-1 accurately describe the impact of quantum mechanical concepts on a person encountering it *initially* as follows [footnote omitted]:
>
>> "Because atomic behavior is so *unlike ordinary experience,* it is very difficult to get used to, and it appears peculiar and mysterious to everyone."

In light of this observation by Feynman, a renowned expositor and pioneering scientist, it becomes easier to understand how difficult it is for those who are more comfortable with intuitive classical physics to bridge the gap leading to the relatively less intuitive, but more challenging, subtleties of quantum mechanics and to eventually see the latter for the powerful tool that it really is. Once that stage is reached, as in the case of a person of skill in the art, the truth behind Feynman et al.'s statement below (p. 1-1) becomes apparent:

>> "[There is] a phenomenon which is impossible, *absolutely* impossible, to explain in *any classical* way, and which has in it the heart of quantum mechanics."

Where the phenomenon referred to above is none other than (p. 1-1):

>> "[T]he *quantum behavior of electrons.*"

In view of the above discussion, it would have come as no surprise to one of' ordinary skill in the art that the improper use of a theory, such as applicant's classical theory, to explain phenomena in a quantum domain, such as the behavior of electrons in atoms, can all too easily lead to erroneous conclusions such as the existence of a "hydrino atom."

Feynman has erred in his statement that the quantum behavior of electrons

cannot be explained by classical laws. His work has set society back a generation or more and demonstrates the failings of outdated quantum theory. Furthermore, quantum theory has the wrong model for the electron, a point particle, which explains why it is "weird," since the wrong model will produce "weird" results.

The physics of the bound electron in atoms, excited states, molecules, and the free electron including scattering behavior and the electron diffraction are explained by Applicant's modern theory, as shown in the following papers:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations,

paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

The predictions from classical laws exactly agree with observations. This was the prediction of the founders of quantum mechanics including Einstein, de Broglie, Schrodinger, and Dirac as discussed in the cited papers.

On page 20 of the Consolidated Appendix, the Committee further incorrectly states:

> It is no easy task to determine a basis for applicant's position in light of the fact that his theory lacks a coherent framework where equations are linked by a logical chain involving proper scientific and mathematical reasoning. As a case in point, see, e.g., pp. 20 and 83 in his book (1999 edition) that demonstrate an absence of logical flow in the mathematics and physics of applicant's theory and exhibit mere conclusionary statements for the end result of applicant's theory which is fractional integer values for the principal quantum number, n, that are not consistent with quantum mechanics.

Applicant has shown in detail in the past and again throughout this Response how his theory is based on classical laws, including Maxwell's equations. The Committee simply refuses to fairly consider these arguments.

The Committee would find it a far easier "task" to evaluate the present invention if it simply considered the experimental evidence of record. It is a far harder task to fabricate new standards and other baseless arguments to avoid considering that evidence.

Furthermore, by far the hardest task faced by the Committee is supporting the "weird" and flawed quantum theory it desperately clings to. For over a decade now, the Committee has utterly failed in its attempt to elevate flawed quantum theory to the level of a physical law. As Applicant has shown in detail, quantum theory does not represent reality, violates physical laws, and is internally inconsistent. If the Committee would simply get past quantum theory, its task of evaluating Applicant's invention would be made far easier.

On pages 20-21 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant holds that such hallmarks of quantum mechanics as the Heisenberg Uncertainty Principle, wave-particle duality, etc. and such

philosophical puzzles posed by quantum mechanics as quantum superposition show that conventional quantum mechanics is flawed. In response, it is noted that, in fact, it is a generally recognized characteristic of quantum mechanics that *it continues to be very successful in practice despite some ongoing philosophical issues.*

Applicant pointed out clear mathematical flaws in quantum theory and how it violates classical laws, which points the Committee has not refuted. Indeed, the Committee now further admits quantum theory's flaws in trying to minimize them as "ongoing philosophical issues." These "philosophical issues" however, are not minor; they are major impediments to an outdated theory that has outlived its usefulness.

On page 21 of the Consolidated Appendix, the Committee further incorrectly states:

> There is no objective evidence that quantum mechanics is either in any danger of being abandoned or considered to be contravened by those recognized for their skill in the art as is clear from Tegmark and Wheeler (2001). Indeed, a measure of the enormously successful impact of quantum mechanics on industry is apparent in the following quotation from Tegmark and Wheeler at p. 69:

>> "[T]he astonishing range of scientific and practical applications that quantum mechanics undergirds: today an estimated *30 percent of the U.S. gross national product is based on inventions made possible by quantum mechanics,* from semiconductors in computer chips to lasers in compact-disc players, magnetic resonance imaging in hospitals, and much more."

Once again, these statements show that Tegmark and Wheeler make ridiculously grandiose statements regarding quantum theory that have no basis in reality. It is true that technologies have been developed that are based on the phenomenon of quantization. But, it can not be said that these technologies would not exist if it were not for probability wave equations (i.e. the Schrodinger equation). This self grandeur of Wheeler is simply nonsense. According to Wheeler, not only technologies but also the existence of the entire universe is dependent on the human mind, which is absurd. In Wheeler's quantum mechanical view of reality, the existence of a computer, a CD player, or an MRI scanner relies upon the human mind to collapse the quantum

wavefunction to make these objects real.[22] The Committee is advised to read the original transistor patent, in which case it will find that it contains NO MENTION OF QUANTUM MECHANICS. It is based purely on empirical material science.

The invention of the transistor was based on phenomenology. The invention of the transistor is covered in Proceedings of the IEEE "Special Issue on the Fiftieth Anniversary of the Transistor", Vol. 86, No. 1, January, (1998). At page 34-36, Shockley's Patent is printed. It is not based on quantum mechanics. It is an engineering description of an amplifier based on properties of semiconductor materials arranged in a particular fashion.

There is no solution of the Schrodinger equation used in solid state physics. The discipline advances empirically and quantum mechanical hand-waving is added after a discovery. Examples include the quantum and integral Hall effects. Then there is the stifling of technology by quantum mechanics. For example, theoreticians violently insisted that high temperature superconductivity could not be possible since it violated BCS theory (incidentally a Noble prize was awarded for the DISCOVERY of high temperature superconductivity and the phenomenon can still not be explained by quantum mechanics theory). The Committee should also note as stated by Weinstein in Section I of this report, that chemists have been impeded by quantum mechanics.

Then there is the laser. Stimulated emission started with Einstein as an additional term to empirically fit Planck's blackbody radiator curve. The laser is completely explained by Maxwell's equations using the mere empirical observation of quantized energy levels.

The invention of the laser was based more on classical physics applied to observed quantum phenomenon. The idea of stimulated emission originated in 1917 (ten years before the Schrodinger equation was postulated) when Einstein proposed that Planck's formula for blackbody radiation could be obtained from an ensemble of atoms with quantized energy levels that under went stimulated and as well as spontaneous emission.[23] This idea was used by Schawlow and Townes in an

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[22] Reference 53.
[23] Reference 66.

extension of classical microwave resonator cavity theory to propose the extension of

MASER techniques to visible wavelengths.[24] Masers were originally described

classically given the phenomenon of quantization—not by using the Schrodinger

equation.

What is even more devastating to the Committee's argument is that the mere

existence of the laser disproves quantum mechanics and the Heisenberg Uncertainty

Principle as pointed out by Carver Meade, Gordon and Betty Moore Professor of

Engineering and Applied Science at Caltech, Feynman's former student, colleague and

collaborator, as well as Silicon Valley's physicist in residence and leading intellectual,

who was recently interviewed on this subject:[25]

> Central to Mead's rescue project are a series of discoveries inconsistent
> with the prevailing conceptions of quantum mechanics. One was the
> laser. As late as 1956, Bohr and Von Neumann, the paragons of quantum
> theory, arrived at the Columbia laboratories of Charles Townes, who was
> in the process of describing his invention. With the transistor, the laser is
> one of the most important inventions of the twentieth century. Designed
> into every CD player and long distance telephone connection, lasers today
> are manufactured by the billions. At the heart of laser action is perfect
> alignment of the crests and troughs of myriad waves of light. Their
> location and momentum must be theoretically knowable. But this violates
> the holiest canon of Copenhagen theory: Heisenberg Uncertainty. Bohr
> and Von Neumann proved to be true believers in Heisenberg's rule. Both
> denied that the laser was possible. When Townes showed them one in
> operation, they retreated artfully.

> In Collective Electrodynamics, Mead cites nine other experimental
> discoveries, from superconductive currents to masers, to Bose-Einstein
> condensates predicted by Einstein but not demonstrated until 1995.
> These discoveries of large-scale, coherent quantum phenomena all
> occurred after Bohr's triumph over Einstein.

Magnetic resonance is also described by Maxwell's equations. In fact, in a

recent communication, Applicant was informed by Dr. Samuel Patz who heads the MRI

Laboratory at the Brigham & Women's Hospital, Harvard Medical School's top research

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[24] Reference 67.

[25] Reference 68.

center, that MRI is taught at Harvard and Massachusetts Institute of Technology as the classical precession of the bulk magnetization vector in a frame rotating at the Larmor frequency due to the application of an applied RF field at the Larmor frequency wherein the bulk magnetization is due to the phenomenon of nuclear spin direction quantization.[26] The Schrodinger equation is not used, and the quantum theory of the nucleus, quantum chromodynamics (QCD), is an utter failure in that it can not predict the existence of the proton and neutron or correctly account for the phenomenon of nuclear spin; whereas, Applicant's theory can. From first principles, Applicant's theory predicts the masses of the proton and neutron and their magnetic moments to within a part per hundred thousand of the observed values in closed form equations containing fundamental constants only.[27]

Simply put, quantum mechanics has failed. It can not explain the most fundamental observations such as the nature of a photon, the electron, the wave-particles duality nature of light and particles (See Section 14 of this Response), the masses of particles, gravity, etc. It has been a complete failure at unification.[28] The Committee has gone to great lengths to establish that Noble prizes have been award in the pursuit of quantum mechanics. The Committee has been diligent at pointing out celebrities of quantum physics. Notably absent from the list are Newton, Einstein, and Maxwell. It doesn't matter how many theoreticians toil at trying to make quantum mechanics work or what fantasies they will tolerate in order to force it to work if it is based on a *false premise*. That false premise is that physical laws such as Maxwell's equations and Newton's laws with Einstein's special relativity do not apply at the atomic level. Physicists have justified the spookiness and absurd consequences of quantum mechanics on the basis that no theory based on physical laws can explain quantum phenomena, such as quantized nature of light and atomic energy levels and the wave-

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[26] Reference 69.

[27] Reference 39 at Proton and Neutron section.

[28] Reference 39, Forward and Introduction Sections.

particle duality. This is absolutely *not true* as shown by Applicant.[29] Classical laws work over 85 orders of magnitude of scale from that of elementary particles to that of the cosmos. Science is not a popularity contest, it is the endless search for the ultimate truth of the workings of the physical universe established by empirical observation (I.E., ESTABLISHED BY DIRECT EXPERIMENTATION). Solipsistic nihilism and self grandeur have no place in science.

And, consider the impact on technology. We could live without quantum mechanics and only accept that empirical result that atomic energy levels are quantized. Quantum mechanics was not even adopted in any serious fashion until well after the seeds were sown for the major technologies cited by the Committee. In contrast, classical laws—Maxwell's equations and Newton's laws—which the Committee argues against by advocating the mutually incompatible quantum mechanics—are ABSOLUTELY INDISPENSABLE FOR MODERN SOCIETY. They are absolutely predictive; whereas, quantum mechanics is NOT.

In contrast to Quantum mechanics, which has never predicted a single technology, Applicant's theory has predicted novel hydrogen chemistry, which is now experimentally confirmed as summarized in Section I of this Response. The match between theoretical predictions and experimental observation are remarkable. Applicant's predicted technology could eclipse the value of those cited by the Committee and could in fact advance them significantly as shown in Applicant's published and soon-to-be published articles .[30]

On page 21 of the Consolidated Appendix, the Committee further incorrectly states:

> Furthermore, as the quotation from Tegmark and Wheeler so tellingly puts it: *"the, experimental verdict is in: the weirdness of the quantum world is real, whether we like it or not"* - and this is as of February 2001.

Applicant fully agrees with the Committee, that outdated quantum theory is "weird" and has no place in reality. Applicant's modern theory is not weird, because it

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[29] Reference 39.

[30] References 2 and 3.

represents the real world and fully accounts for the state-of-the-art experimental evidence of record demonstrating the existence of lower energy states. In contrast, outdated quantum theory forbids these lower energy states and does not comply with modern experimental data.

On page 21 of the Consolidated Appendix, the Committee further incorrectly states:

> In light of these viewpoints expressed by those of skill in the art, it would appear, on the balance, that the applicant's opinion that "Quantum theory cited [sic] makes nonsensical, nonphysical predictions ... "(at p. 16 of the amendment) clearly lacks probative value.

> It turns out, Applicant's rejection of QM is <u>solely</u> caused by Applicant's misunderstanding and misinterpretation of the QM, the latter having been acknowledged in the art as being the most successful theory in the whole history of physics. The validity of QM has been quantitatively verified by multiple generations of physicists/scientists and by thousands, if not millions of phenomena and effects encountered in science and technology.

> In contrast, applicant's flawed "theory" has not been verified even by a single experiment conducted by an independent third party to date. Thus, Applicant's argument regarding alleged flaws in QM is unpersuasive.

Instead of directly responding to Applicant's evidentiary arguments regarding the numerous flaws of quantum theory, the Committee merely cites unsupported "viewpoints" and boasts of supposed quantitative verifications that have no connection to the validity of that theory.

Once again, Applicant points out the obvious in stating that outdated quantum theory is based on mathematical rules **without any physical foundation**. It is important to note that the Schrodinger equation (quantum theory) is not physical since it deals with an all space (everywhere at once) point-particle probability wave. It also does not give the correct solution of the energy levels of even the simplest atom, hydrogen. **Quantum theory misses spin, the electron g factor, the Lamb shift, the fine structure, the hyperfine structure, degeneracy of excited states, lack relativistic invariance, is not stable to radiation of the n=1 state, violates**

conservation of energy and angular momentum as well as casualty to mention just a few of the fatal flaws as pointed out in previous publications:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

Beyond the simplest atom, nothing can be solved using outdated quantum theory since the mathematics involves multi-body problems. Approximations with nonphysical assumptions and adjustable parameters are the techniques employed, wherein physics

is replaced by untestable pure mathematics. Further, the mathematics associated with quantum theory is obviously internally inconsistent, since no two theoreticians use the same adjustable parameters, and, thus, that flawed theory fails to meet the Committee's own credibility standard.

This ad hoc approach is extended to molecule solutions. For example citing from Applicant's paper [R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389], in Table 9-1, McQuarrie [D. A. McQuarrie, Quantum Chemistry, University Science Books, Mill Valley, CA, (1983), pp. 343-422] presents 13 different methods for the calculation of the parameters of the hydrogen molecule. None are rigorous, physical, unique, and internally consistent, and the methods are themselves internally inconsistent and often contradictory. The number of terms in the wavefunctions span two to 100 and all involve mixing of the wavefunctions as given in Eq. (3-5) with variable parameters. Exemplary algorithms include valence bond, valence bond plus ionic terms, molecular orbital theory, molecular-orbital with configuration interaction, self consistent field method, SCF-LCAO-MO, Hartree-Fock, valence-shell electron-pair-repulsion (VSEPR) method, etc. In all of these and other such approaches, there is total disregard to conservation of energy, momentum, and radiation according to Maxwell's equations. The approaches involve an inconsistent plethora of invented wavefunctions and terms—Slater orbitals, ionic terms, molecular orbital with sigma bonds, pi bonds, delta bond, banana bonds, bonding orbitals, antibonding orbitals, (negative probability density as well as positive probability density), back-bonding orbitals (empty space), overlap, coulomb, and exchange integrals—all with intractable infinities. Ad hoc, inconsistent types of adjustable parameters such as effective nuclear charge, ionic character, correlation interactions, and arbitrary renormalization procedures to remove infinities are introduced to force the calculations to match observations.

In contrast, Applicant's modern theory uses physical laws to exactly solve the energy levels of atoms, excited states, spin, the electron g factor, the Lamb shift, the fine structure, the hyperfine structure, degeneracy of excited states, relativistic invariance, stability to radiation of the n=1 state, and conservation of energy and angular momentum as given in the above cited references 1-10. These results are

extended to give exact solutions of polyatomic molecules as given in Chps. 11, 13 and 14 of Mills GUT, an achievement that is unmatched by SQM.

A further failure of quantum theory is that the electron cloud that is everywhere at once that would give rise to a self energy that is in addition to the predicted infinities of the Schrodinger equation "SE" and the Dirac equation "DE". This is discussed in Appendix IV of Mills GUT. Furthermore, the renormalization of quantum electrodynamics is ad hoc and fluid with terms debated for decades as discussed in Appendix II of Mills GUT. There are no infinities observed in Nature, and the prediction of such infinities cannot be mathematically waved away as argued by even Dirac. (See Appendix II of Mills GUT). SQM how every it is defined which is also fluid (SE, DE, quantum electrodynamics, etc.) does not predict the stability of the hydrogen atom and is not the correct model. It many failings are discussed in detail in Mills GUT such as the following excerpt from Appendix II:

Quantum theory failed to predict the results of the Stern-Gerlach experiment which indicated the need for an additional quantum number. Quantum electrodynamics was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. It relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors. From Weisskopf [49], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; 1.) does not explain nonradiation of bound electrons; 2.) contains an internal inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite; 3.) it admits solutions of negative rest mass and negative kinetic energy; 4.) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; 5.) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. In 1947, contrary to Dirac's predictions, Lamb discovered a 1000 MHz shift between the $^2S_{1/2}$ state and the $^2P_{1/2}$ state of the hydrogen atom [50]. This so called Lamb Shift marked the beginning of modern quantum

electrodynamics. In the words of Dirac [51], "No progress was made for 20 years. Then a development came initiated by Lamb's discovery and explanation of the Lamb Shift, which fundamentally changed the character of theoretical physics. It involved setting up rules for discarding ...infinities..." Renormalization is presently believed to be required of any fundamental theory of physics [52]. However, dissatisfaction with renormalization has been expressed at various times by many physicists including Dirac [53] who felt that, "This is just not sensible mathematics. Sensible mathematics involves neglecting a quantity when it turns out to be small—not neglecting it just because it is infinitely great and you do not want it!"

Throughout the history of quantum theory, wherever there was an advance to a new application, **it was necessary to repeat a trial-and -error experimentation to find which method of calculation gave the right answers**, i.e. curve fitting. Often the textbooks present only the successful procedure as if it followed from first principles and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle to fit the empirically successful algorithm. For example, we know that it required a great deal of art and tact over decades of effort to get correct predictions out of QED. The QED method of the determination of $(g-2)/2$ from the *postulated* Dirac equation is based on a *postulated* power series of α/π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term which is processed over decades using ad hoc rules to remove infinities from each term that arises from *postulated* scores of *postulated* Feynman diagrams. The solution so obtained using the perturbation series further requires a *postulated* truncation since the series **diverges**. Mohr and Taylor reference some of the Herculean efforts to arrive at g using QED [54]:

"the sixth-order coefficient $A_1^{(6)}$ arises from 72 diagrams and is also known analytically after nearly 30 years of effort by many researchers [see Roskies, Remiddi, and Levine (1990) for a review of the early work]. It was not until 1996 that the last remaining distinct diagrams were calculated analytically, thereby completing the theoretical expression for $A_1^{(6)}$".

For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off

the infinities) in one particular way and not in some other way that appears in principle equally valid. For example, Milonni [55] presents a QED derivation of the magnetic moment of the electron which gives a result of the wrong sign and requires the introduction of an

"upper limit K in the integration over $k = \omega/c$ in order to avoid a divergence."

A differential mass is arbitrarily added, then

"the choice $K = 0.42mc/\hbar$ yields $(g-2)/2 = \alpha/2\pi$ which is the relativistic QED result to first order in α. [...] However, the reader is warned not to take these calculations too seriously, for the result $(g-2)/2 = \alpha/2\pi$ could be obtained by retaining only the first (radiation reaction) term in (3.112) and choosing $K = 3mc/8\hbar$. It should also be noted that the solution $K \cong 0.42mc/\hbar$ of (3.112) with $(g-2)/2 = \alpha/2\pi$ is not unique."

Such an ad hoc nonphysical approach makes incredulous:

" the cliché that QED is the best theory we have!" [56]

or the statement that:

"The history of quantum electrodynamics (QED) has been one of unblemished triumph" [57].

There is a corollary, noted by Kallen: from an inconsistent theory, any result may be derived.

The quantum theory determination of the postulated power series in α/π is based on scores of Feynman diagrams corresponding to thousands of matrices with thousands of integrations per matrix requiring decades to reach a consensus on the "appropriate" algorithm to remove the intrinsic infinities. Remarkably, $(g-2)/2$ may be derived in closed form from Maxwell's equations in a simple straightforward manner that yields a result with eleven figure agreement with experiment—the limit of experimental capability. Rather than an infinity of radically different QED models, an essential feature is that *Maxwellian solutions are unique*. The derivation from first principles without invoking virtual particles, zero point fluctuations of the vacuum, and negative energy states of the vacuum is given in the Electron g Factor section.

Furthermore, Oskar Klein pointed out a glaring paradox implied by the Dirac equation which was never resolved [58]. "Electrons may penetrate an electrostatic barrier even when their kinetic energy, $E - mc^2$ is lower than the barrier. Since in Klein's example the barrier

was infinitely broad this could not be associated with wave mechanical tunnel effect. It is truly a paradox: Electrons too slow to surpass the potential, may still only be partially reflected. ...Even for an infinitely high barrier, i.e. $r_2 = 1$ and energies $\approx 1\,MeV$, (the reflection coefficient) R is less than 75%! From (2) and (3) it appears that as soon as the barrier is sufficiently high: $V > 2mc^2$, electrons may transgress the repulsive wall—seemingly defying conservation of energy. ...Nor is it possible by way of the positive energy spectrum of the free electron to achieve complete Einstein causality."

The Rutherford experiment demonstrated that even atoms are comprised of essentially empty space [59]. Zero-point field fluctuations, virtual particles, and states of negative energy and mass invoked to describe the vacuum are nonsensical and have no basis in reality since they have never been observed experimentally and would correspond to an essentially infinite cosmological constant throughout the entire universe including regions of no mass. As given by Waldrop [60], "What makes this problem into something more than metaphysics is that the cosmological constant is observationally zero to a very high degree of accuracy. And yet, ordinary quantum field theory predicts that it ought to be enormous, about 120 orders of magnitude larger than the best observational limit. Moreover, this prediction is almost inescapable because it is a straightforward application of the uncertainty principle, which in this case states that every quantum field contains a certain, irreducible amount of energy even in empty space. Electrons, photons, quarks—the quantum field of every particle contributes. And that energy is exactly equivalent to the kind of pressure described by the cosmological constant. The cosmological constant has accordingly been an embarrassment and a frustration to every physicist who has ever grappled with it."

See also the following papers:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative

Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

In contradiction to the Committee's position, Applicant's theory, based on classical laws, does predict precisely and exactly all of the observations recorded on the hydrogen atom including the deficiencies of the SE and DE . These include the Lamb shift (SE and DE), spin (SE), g factor (SE and DE) as well as the correct lifetimes of excited states (SE and DE), stability to radiation (DE, SE) and causality (SE, DE).

The necessity of outdated quantum theory to patch together inconsistent theories that are purely postulated, internally inconsistent, and incongruent with observations such as the causality of the physical world, the lack of infinities, and the absence of an infinite cosmological constant , for example, in order to explain conjugate parameters demonstrates the obvious—the only success of these equations can be attributed to the simple fact that they were postulated in order to match one aspect of Nature that was already known. It is obvious the Schrodinger equation for example is simply another mathematical way of writing the known Rydberg formula to which it reduces. But, these

equations have no predictive capability since they are only pure mathematics with no basis in reality. They are NOT PHYSICAL and do not represent the hydrogen atom.

On page 22 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant has stressed that his theory is based on "first principles." The basis for this seems to lie in applicant's use of a classical wave equation supplemented by a certain boundary condition. In contrast, according to the applicant's own notion, the Schrodinger equation of quantum mechanics is a "theory which was curve-fitted" (see p. 16 of the amendment). Such an argument is illogical.
>
> Both the classical wave equation and the Schrodinger wave equation are descriptive of wave phenomena, with the crucial differences being that the quantum wave function in Schrodinger's equation is interpreted in probabilistic terms and that Schrödinger's equation is applicable in the quantum domain whereas the classical wave equation is not. Following applicant's own logic, it is apparent that a theory based on the Schrodinger equation is entitled to be just as much of a "first principles" theory as is applicant's theory. Therefore, any argument that the applicant's theory is more fundamental or well-founded than, for instance, quantum mechanics based on Schrödinger's equation is without merit. [Footnote omitted.]

The Schrodinger equation is a type of diffusion equation. It is NOT physical, as discussed in Mills GUT and the following references:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

The Committee has not refuted the evidence shown in these fourteen references. Furthermore, the Committee admits that the Schrodinger equation does not account for spin and, thus, cannot be based on first principles for this reason alone.

On page 23 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant's use of a classical wave equation to describe quantum phenomena is incorrect. Attention is drawn to a state-of-the-art standard graduate level textbook in quantum mechanics by Schiff (1968) which, on page 21, demonstrates the necessity of formulating a wave equation *that is more fundamental and general than the classical wave equation.* See, especially, lines 11-12 and lines 22-23 on p. 21 of Schiff. In particular, *the use of a classical wave equation is to be avoided* for the reason that in a classical wave equation depicted, e.g., by:
>
> [equation omitted]
>
> the second partial derivative with respect to time, i.e. $\partial 2 0/\partial t?$, introduces parameters of motion (momentum, energy, frequency, etc.) into ~ thus preventing one from being able to superpose solutions that belong to different values of the parameters in order to obtain a general solution.
>
> While the above argument is shown in the context of a 1-dimensional classical wave equation, it is equally applicable to the applicant's 3-dimensional classical wave equation (see equation (1.2) on p. 2 of his book) given the correspondence between the above classical wave equation and applicant's classical wave equation when $0 \longrightarrow p$ and $y = 1$.

In contrast to the classical wave equation, it turns out that a more fundamental and general equation aptly suited to describe quantum behavior, such as Schrodinger's equation, *ih 30/Ut*

$$z,\varnothing E—(h^2/2m)A^2\varnothing+V(r)\sim b,$$

contains *a first* partial derivative with respect to time, *30/34 where such a problem does not arise.* (See p. 3 for the meaning of the above symbols.) By resurrecting a mathematically discredited approach the applicant has introduced a clear error into his theory thereby raising serious questions regarding the credibility of any conclusions derived from his classical wave equation-based theory, such as, the existence of a "hydrino atom."

Incidentally, it is noted that applicant's classical wave equation (cf. equation (1.2) on p. 2 of his book, the 1999 edition) is *improper* in that the second derivative with respect to time is shown as "#/o?" which denotes a second-order finite difference operator. To the examiner's knowledge, there is *no* classical wave equation with such an operator. The standard classical wave equation contains the (infinitesimal) partial differential operator *"02/31"* which has quite a different connotation, *zi~.:*

[equation omitted]

wherefl3c,t) is a proper test function. Applicant's use of an improper equation is an additional reason as to why the *results* from his *improper* theory cannot be relied upon.

Based on the above discussion, it is reasonable to hold that applicant's improper use of a classical wave equation to describe a quantum mechanical system, such as a hydrogen atom, introduces a fundamental error in his theory which would have caused a person of ordinary skill to question the credibility of any results derived therefrom, such as the "hydrino atom" characterized by energy levels with fractional integer values for the principal quantum number, *n.*

Once again, Applicant conclusively demonstrated that the Schrodinger equation is a type of diffusion equation and is NOT physical. See the following references, which the Committee has not rebutted:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.

3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.

8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.

12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.

13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.

14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

Applicant's modern theory correctly uses a classical wave equation as the equation of motion of the electron, since for the correct solutions, angular momentum and energy are conserved. This is not the case for the Schrodinger diffusion equation.

Applicant's classical wave equation is correct as given in any basic physics book. And, it is used correctly to obtain the spherical and time harmonic solutions of this equation of motion as shown in Mills GUT. The Committee has not shown otherwise.

The Committee's lack of understanding regarding the classical wave equation is further evidenced by it citation to Dr. Rathke's article. In Dr. Rathke's article, Eq. (9), the falsified wave equation that was not recognized by the Committee.

On page 25 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant's use of a boundary condition, based on a paper by Haus entitled "On the radiation from point charges," (Haus, H. (1986) *.e4merican Journal of Physics,* vol. 54, no. 12, pp. 1126-1 129. See attachment 17) is unjustified. In order to place applicant's argument in proper perspective, it is noted that from a purely classical point of view an accelerated charge radiates energy. See, e.g., Jackson **(1975)** at p. 654. If one were to extend this argument to an electron in a hydrogen atom whose nucleus consists of a single proton, then, *classically speaking,* one would expect the electron to continuously radiate away energy as it spirals towards and eventually collapses into the positively charged nucleus. 'So, classically speaking again, the hydrogen atom cannot exist. Reality, however, dictates otherwise - hydrogen atoms clearly exist. Their spectra have been measured. What, then, is the explanation for the stability of the hydrogen atom? *Clearly, using classical concepts to describe a hydrogen atom leads to unrealistic conclusions such as the collapse of the atom.*

Not surprisingly, the same problem also occurs in the applicant's theory of the hydrogen atom given its origins in a classical wave equation. It is contended that any argument by the applicant that the failure of the classical wave equation is somehow remedied in his theory by using a boundary condition based on Haus's paper is devoid of merit in light of the following facts:

(i) Haus's paper deals with an electron being a *point* charge whereas, by applicant's own admission on p. 17 of the amendment, in applicant's theory the electron is *not a point charge.* Therefore, Haus's boundary condition for a point charge *cannot* **be applied to applicant's "electron"** which is *not* a point charge without producing a scientifically unacceptable result.

It is observed that on p. 54 of the amendment, the applicant stated that "The Haus derivation applies to a moving charge-density function as well because charge obeys superposition."

This raises two issues. Firstly, since the applicant has *not* shown that a *superposition of point charges* is the *same thing* as his *"extended" or "two-dimensional" electron,* his response falls short of meeting the thrust of the examiner's contention. Secondly, since the applicant fails to take into account the self-energy of his electron (or charge-density distribution), or, the interactions that occur between the different (or superposed) components representing the internal structure of his electron, especially, in light of his admission that his electron is not a point charge, it is deemed that applicant has not shown that there is proper scientific basis to apply

Haus's boundary condition for a point charge to applicant's electron which is not a point charge.

(ii) Haus's 'paper is relevant to *a free electron* laser whereas applicant's theory is concerned with an *atom where the electron is not a free electron.* That is, in Haus's paper there is no proton exerting a Coulomb force on an electron as in the case of the hydrogen atom. These issues were previously raised by the examiner on p. 4 of the Appendix attached to the previous office action but have yet to receive a satisfactory reply from the applicant. Since the two areas of application (free electron laser and the hydrogen atom) are *prima facie* different and constitute, in essence, *non-analogous art,* once again it is evident that Haus's boundary condition which was used in the context of a free electron laser cannot be bodily incorporated into a theory of the hydrogen atom without leading to scientifically unacceptable results.

(iii) It is noted that Haus's intent was to provide an *alternative* explanation, based on Fourier transforms, as to why a charge moving at *constant* velocity does not radiate energy. Furthermore, Haus's paper is *confined* to dealing with the equations of *macroscopic* electrodynamics (very first sentence in his paper). Therefore, a proper application of Haus's boundary condition to a quantum mechanical system such as the hydrogen atom *cannot* be made unless there is *evidence* that the electron in the hydrogen atom moves at *constant* velocity and a proper analysis is conducted to determine whether, in fact, the equations of *macroscopic* electrodynamics would be applicable to a *microscopic* system such as the hydrogen atom. It is only proper scientific procedure to determine the realm of validity of Haus's boundary condition before hinging one's conclusions on the results obtained therefrom. There is nothing in the record of the existence of such evidence and of such analysis as having been performed.

It is concluded that applicant has applied Haus's derivation in a purely mathematical manner *out of context* to an electron in a quantum mechanical system, such as the hydrogen atom, without proper mathematical and scientific justification.

Applicant's bound $n=1$ electron is magneto and electrostatic; thus, it is trivially nonradiative. Applicant has applied the Haus condition as well as that of others such as:

G. Goedecke, Phys. Rev 135B, (1964), p. 281.

J. Daboul and J. H. D. Jensen, Z. Physik, Vol. 265, (1973), pp. 455-478.

P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.

T. A. Abbott, D. J. Griffiths, Am. J. Phys., Vol. 53, No. 12, (1985), pp. 1203-1211.,

to the p,d,f. states of the bound electron and has shown that there is precise agreement between predictions and experimental observations. (See in particular Appendix I and Chps 1, 2, 7, 9, and 10 of Mills GUT).

Applicant has also shown that physical laws including Maxwell's equations do apply to the level of the atom. As Einstein, Schrodinger, Dirac, de Broglie and other founders of quantum mechanics expected, but could not show, physical laws do apply at the level of the atom. The results are given in Mills GUT and the following papers:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

In contrast, outdated quantum theory never solved the structure of the electron or the basis of stability of the atom. Flawed quantum theory is inconsistent, incomplete, and not based on physical laws. Thus, quantum theory is irrelevant now that Applicant's modern theory solves the electron using classical laws and the "weirdness" and short comings of quantum theory have been eliminated.

On page 28 of the Consolidated Appendix, the Committee further incorrectly states:

> The examiner had previously raised the issue of the implosion or lack of stability of the "hydrino atom" on p. 4 of the Appendix to the previous office action. In his response, on pp. 57-58 of the amendment, the applicant refers to "conservation of energy" as shown in Chapter 5 of his book as accounting for the alleged stability of the "hydrino atom." The examiner has consulted Chapter 5, pp. 138-161, in the book but finds the issue to be as yet *unresolved.* Thus pp. 138-159 deal essentially with a catalytic system based on tapping into alleged energy states of the "hydrino atom" and do not come to grips with the issue of the instability of the "hydrino atom" in the first place. Page 160 indicates that "[h]ydrogen atoms can undergo transitions to energy states below the ground state until the total potential energy of the *proton* is converted to relativistically corrected kinetic energy and total energy." Emphasis added. However, it is not understood as to what the potential energy of the *proton* has to do with the energy of an *electron,* especially, when the issues of interest are the energy states of the electron. Moreover, since the total energy *is* the sum of the potential and kinetic energies, no meaning can be ascribed to applicant's statement that the potential energy is converted to *inter alia* total energy. It appears that applicant has given a *confusing* and *conclusionary* statement that alleges that something *can* happen as opposed to just what does happen. It is evident that applicant's response regarding the lack of stability of the "hydrino atom" is clearly unpersuasive.

This issue regarding the stability of the hydrino atom is not "unresolved" as alleged by the Committee. Applicant's modern theory clearly teaches how the hydrino atom is stable, and the extensive experimental evidence of record supports his theory by conclusively demonstrating these stable lower-energy states. Nevertheless,

Applicant will once again respond.

The rigorous derivations from Maxwell's equations of the stability of the $n = \text{integer}$ and $n = 1/\text{integer}$ states of atomic hydrogen are given in the Stability of Atoms and Hydrinos section of Applicant's publications .[31] The lowest-energy-state hydrino according to Maxwell's equations is given in the New "Ground" State section of Applicant's publications.[32] Contrary to the assertion of the Committee, hydrinos are stable according to Maxwell's equations as demonstrated by Applicant. They are further shown to be experimentally stable since they exist in novel compounds, included in the extensive experimental evidence of record mostly ignored by the Committee.

It is surprising to Applicant that the Committee does not know that "total energy" is a term of art in quantum mechanics which refers to the sum of the potential energy due to the field of the proton and the kinetic energy of the electron and is equal in magnitude to the binding energy of the electron. On page 24 of McQuarrie appears, "The total energy of the electron is equal to the sum of its kinetic energy and potential energy" which arises to the Coulomb field of the electron.[33] The potential energy due to the proton's field is <u>not infinite</u>, as predicted by Quantum Theory, the maximum potential energy corresponds to the finite radius of the nucleus. Applicant gives the lowest energy state possible described in the "New Ground State" section.[34]

The $n = 1$ solution of the Schrodinger equation is BY DEFINITION—NOT BY PHYSICS. No physical basis is put forward to explain why the electron is stable in the hydrogen atom. In fact, quantum mechanics is purely postulated—not based on directly testable physical laws—only distortions of corresponding properties of these laws embodied as "operators". Such arbitrary creations include Hund's Rule, color conservation, flavor conservation, spin of fermions and bosons, parity, the Pauli Exclusion Principle, and the Schrodinger equation with its definition of the "ground

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[31] Reference 39 at Chapter 6.

[32] Reference 39 at Chapter 5.

[33] Reference 65 at page 24.

[34] Reference 39 at Chapter 5.

state" solution of the hydrogen atom. As discussed in this Response, since the Schrodinger equation is not based on physical laws it predicts a continuum of states. Thus, the "ground state" definition is essential for the Schrodinger equation to match the experimental Rydberg series. Applicant should not be prejudiced by the Committee's recalcitrance to admit this fact of the Schrodinger equation. And, even with this definition, the Schrodinger solution fails. For example, the Schrödinger equation solution must radiate according to Maxwell's equations. [35]

Feynman's derivation of the Bohr radius based on the Uncertainty Principle is flawed on the basis of the at least five points shown by Applicant.[36] And, the experimentally confirmed shortcomings of the Schrödinger equation and Dirac equations are also addressed in the Sections I, 2-4, 6, 14, and 17 of this Response.

The hydrogen atom derived by Applicant from first principles matches the hydrogen spectrum including the Lamb shift. It succeeds were quantum mechanics has failed .[37] Some of its astonishing successes are summarized in the following except from R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition, Introduction; also see the Forward section, pp. 34-35:

> The novel theory of Classical Quantum Mechanics (CQM) unifies Maxwell's Equations, Newton's Laws, and General and Special Relativity. The closed form calculations of a broad spectrum of fundamental phenomena containing fundamental constants only are given in subsequent sections. CQM gives closed form solutions for the atom which give four quantum numbers, the Rydberg constant, the stability of the $n = 1$ state and the instability of the excited states, relativistic invariance of the wave equation, the equation of the photon and electron in excited states, the equation of the free electron, and photon which predict the wave particle duality behavior of particles and light. The current and charge density functions of the electron may be directly physically interpreted. For example, spin angular momentum results from the motion of negatively charged mass moving systematically, and the equation for angular momentum, $r \times p = \hbar$, can be applied directly to the

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[35] See The POSTULATED Schrodinger Equation Does Not Explain the Stability of the Hydrogen Atom section of Reference 32 and Chapter 35 of Reference 39.

[36] Reference 32.

[37] Reference 32.

wave function (a current density function) that describes the electron. The magnetic moment of a Bohr magneton, Stern Gerlach experiment, electron and muon g factors, Lamb shift, resonant line width and shape, selection rules, correspondence principle, wave particle duality, excited states, reduced mass, rotational energies and momenta, spin-orbital coupling, Knight shift and spin-nuclear coupling, closed form solutions for one, two, and three electron atoms, excited states of the helium atom, elastic electron scattering from helium atoms, proton scattering from atomic hydrogen, the nature of the chemical bond, bond energies, vibrational energies, rotational energies, and bond distances of hydrogen-type molecules and molecular ions, Davisson Germer experiment, Aspect experiment, Durr experiment on the Heisenberg Uncertainty Principle, Penning trap experiments on single ions, hyperfine structure interval of positronium, magnetic moments of the nucleons, beta decay energy of the neutron, the binding energy of deuterium, and alpha decay are derived in closed form equations based on Maxwell's equations. The theory of collective phenomena including statistical mechanics, superconductivity and Josephson junction experiments, integral and fractional quantum Hall effects, and the Aharonov-Bohm effect is given. The calculations agree with experimental observations.

From the closed form solution of the helium atom, the predicted electron scattering intensity is derived. The closed form scattering equation matches the experimental data; whereas, calculations based on the Born model of the atom utterly fail at small scattering angles. The implications for the invalidity of the Schrödinger and Born model of the atom and the dependent Heisenberg Uncertainty Principle are discussed.

For any kind of wave advancing with limiting velocity and capable of transmitting signals, the equation of front propagation is the same as the equation for the front of a light wave. By applying this condition to electromagnetic and gravitational fields at particle production, the Schwarzschild metric (SM) is derived from the classical wave equation which modifies general relativity to include conservation of spacetime in addition to momentum and matter/energy. The result gives a natural relationship between Maxwell's equations, special relativity, and general relativity. It gives gravitation from the atom to the cosmos. The gravitational equations with the equivalence of the particle production energies permit the equivalence of mass/energy and the spacetime wherein a *"clock" is defined that measures "clicks" on an observable in one aspect, and in another, it is the ruler of spacetime of the universe with the implicit dependence of spacetime on matter-energy conversion.* The masses of the leptons, the quarks, and nucleons are derived from this metric of spacetime. The universe is time harmonically oscillatory in matter, energy, and spacetime expansion and contraction with a minimum radius that is the gravitational radius. In closed form equations with

fundamental constants only, CQM gives the basis of the atomic, thermodynamic, and cosmological arrows of time, the deflection of light by stars, the precession of the perihelion of Mercury, the Hubble constant, the age of the universe, the observed acceleration of the expansion, the power of the universe, the power spectrum of the universe, the microwave background temperature, the uniformity of the microwave background radiation, the microkelvin spatial variation of the microwave background radiation measured by DASI, the observed violation of the GZK cutoff, the mass density of the universe, the large scale structure of the universe, and the identity of dark matter which matches the criteria for the structure of galaxies and spectral lines from interstellar medium and the Sun which have been observed in the laboratory [25-26]. In a special case wherein the gravitational potential energy density of a blackhole equals that of the Planck mass, matter converts to energy and spacetime expands with the release of a gamma ray burst. The singularity in the SM is eliminated.[38]

On page 28 of the Consolidated Appendix, the Committee further incorrectly states:

> It proves instructive, at this point, to turn one's attention to Tegmark and Wheeler (2001) who, on page 70, state that the correct explanation for the stability of the hydrogen atom, due to Bohr, is that an electron in a hydrogen atom exists in any one of a number of stable quantum energy states known as stationary states. [Footnote omitted.] *These stationary states are precisely the energy states that are logically obtained by solving Schrodinger's equation subject to proper boundary conditions.*

This conclusory statement regarding the "known" stationary states of hydrogen is based on old experimental evidence. Applicant's state-of-the-art experimental evidence clearly demonstrates the existence of lower energy states, which the Committee mostly ignores. Furthermore, Wheeler's comments are not credible. As stated previously, according to Wheeler, not only technologies but also the existence of the entire universe is dependent on the human mind, which is absurd. In Wheeler's quantum mechanical view of reality, the existence of a computer, a CD player, or an MRI scanner relies upon the human mind to collapse the quantum wavefunction to make these objects real.[39]

On pages 28-29 of the Consolidated Appendix, the Committee further incorrectly states:

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[38] References 27 and 39.

As evidence the examiner refers to pp. 19-1 to 19-18 in Feynman et al.
(1965) which was cited and attached to the Appendix in the previous office
action. The *lowest* energy state occupied by the electron is known as the
ground state and is characterized by the quantum numbers n 1 and $l = 0$.
It stands to reason that there cannot be any state lower than, i.e. below,
the ground state. Therefore, applicant's statement that "[h]ydrogen atoms
can undergo transitions to energy states below the ground state" on p. 160
of his book (the **1999** edition) is incorrect.

Applicant has shown previously and throughout this Response how Feynman is
wrong, which showing the Committee has not rebutted. Applicant requests that the
Committee step out of the past in citing over 40-year-old experimental data from 1965
and move forward by considering Applicant's modern-era data that conclusively
demonstrates the existence of lower energy states.

The Committee is confused by its insistence that correct mathematics equates to
correct physics. It does not matter that the Heisenberg Uncertainty Principle (HUP) follows
from the probability-wave description of the Schrodinger equation (SE). This description of
the electrons in NOT based in reality.

The Committee is relying on the false presumption of the validity of the SE and the
prediction that the electron has no physical form, but is every where at once with an infinite
number of positions and energies simultaneously, to the justify a further distortion of reality—
that the momentum and position of an electron can not be single valued even in the absence
of measurement. Such a situation violates all physical laws and is not in agreement with
causality or reality in general as pointed out in detail in the following paper:

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom
According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, Vol. 30, No. 2,
(2005), pp. 129-151.

Despite these uncontraverted facts, the Committee continues to elevate the
Schrodinger equation to the status of a physical law that cannot be violated—even though
the Committee admits it is flawed in failing to account for electron spin and relativity. It then
extrapolates that absurd proposition as a basis for establishing the supposed "ground state"

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[39] Reference 53.

of hydrogen to the exclusion of lower energy states. Now that is incredible, not the existence of these lower energy states discovered by Applicant.

On page 29 of the Consolidated Appendix, the Committee further incorrectly states:

> While occupying a stationary state the electron does not radiate energy. That is why the hydrogen atom does not collapse - just as nature has it. There is no need at all to invoke extraneous equations and borrow special boundary conditions *since the Schrodinger equation is the proper equation, within a non-relativistic spin-free framework, describing the behavior of the electron and suffices to answer scientifically meaningful questions about the quantum energy levels of the electron.*

Applicant has shown throughout this Response the numerous flaws of the Schrodinger equation and need not repeat them here. Suffice it to say that failure of the Schrodinger equation to account for spin and relativity demonstrates its inherent flaws. In contrast, Applicant's more advanced, modern theory fully accounts for relativity and spin.

On page 29 of the Consolidated Appendix, the Committee further incorrectly states:

> Previously, the examiner had previously set forth Feynman et al.'s elucidation of the stability of the hydrogen atom based on an application of the Heisenberg Uncertainty Principle. **See Endnote 3 (formerly Endnote 5).**

Endnote 3, referred to above, provides:

> It is noteworthy that this position is also supported by a different line of argument that is independent of the solution to Schrodinger's equation. Thus, fractional values for the principal quantum number *n* would bring the electron much closer to the nucleus of the hydrogen atom than is permitted by Heisenberg's Uncertainty Principle. Feynman has presented a mathematically simple argument, in his "Lectures in Physics," vol. III, page 2-6, to show that the size of the hydrogen atom i.e. when n is I (rather than, say, 1/2) is perfectly consistent with the Uncertainty Principle. This argument goes as follows: from the Uncertainty Principle, if the electron is at a distance a from the hydrogen nucleus, then the product of its momentum and a must be of the order of Planck's constant. Now the total energy of the electron is the sum of its kinetic and potential energies. Noting that the kinetic energy can be expressed in terms of the square of the momentum, upon invoking the value of the momentum from the Uncertainty Principle and minimizing the total energy in order to obtain the

lowest energy level of the electron, one immediately obtains the standard
result for the lowest energy level of the electron in the hydrogen atom
which is consistent with ii being 1 and no lower than 1. Since, according to
Feynman, "no one has ever found (or even thought of) a way around the
Uncertainty Principle ... so we must assume it describes a basic
characteristic of nature," (page 1-9 in Feynman) it appears that Mills'
fractional value for n is impermissible in light of the inviolability of the
Uncertainty Principle.

Again, the Committee is confused by its insistence that correct mathematics equates

to correct physics. It does not matter that the Heisenberg Uncertainty Principle (HUP) follows

from the probability-wave description of the Schrodinger equation (SE). This description of

the electrons in NOT based in reality.

The Committee is relying on the false presumption of the validity of the SE and the

prediction that the electron has no physical form, but is every where at once with an infinite

number of positions and energies simultaneously, to the justify a further distortion of reality—

that the momentum and position of an electron can not be single valued even in the absence

of measurement. Such a situation violates all physical laws and is not in agreement with

causality or reality in general as pointed out in detail in the following paper:

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom

According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, Vol. 30, No. 2,

(2005), pp. 129-151.

Despite these uncontraverted facts, the Committee continues to elevate the

Schrodinger equation to the status of a physical law that cannot be violated—even though

the Committee admits it is flawed in failing to account for electron spin and relativity. It then

extrapolates that absurd proposition as a basis for establishing the supposed "ground state"

of hydrogen to the exclusion of lower energy states. Now that is incredible, not the existence

of these lower energy states discovered by Applicant.

The Committee's argument also demonstrates its lack of understanding of the

Uncertainty Principle. The uncertainty in the momentum—not the momentum—may be

determined from the Uncertainty Principle. Thus, there is no basis for the Committee's broad

conclusion that the momentum of the electron in the hydrogen atom can be determined from

the Uncertainty Principle.

The Committee cites the Uncertainty Principle as a law of nature and cites Feynman that no one has found a way around it. This is simply incorrect. Durr et al. [S. Durr, T. Nonn, G. Rempe, Nature, September 3, (1998), Vol. 395, pp. 33-37 (Attachment 58)] have found a way around it, and the Uncertainty Principle was demonstrated experimentally to fail in a test of its long-touted basis of the wave-particle duality. See "It has Been Shown Experimentally that the Heisenberg Uncertainty Principle Has Nothing to Do with Wave-Particle Duality" section of R. Mills, The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, pp. 64-65 in press (Attachment 9), which states:

> Feynman states [117], " It is impossible to design an apparatus to determine which hole the electron passes through, that will not at the same time disturb the electrons enough to destroy the interference pattern." If an apparatus is capable of determining which hole the electron goes through, it *cannot* be so delicate that it does not disturb the pattern in an essential way. No one has ever found (or even thought of) a way around the Uncertainty Principle. *So we must assume that it describes a basic characteristic of nature.*"
>
> Feynman's position has recently been overturned by an experiment by Durr et al. [118]. According to Gerhard Rempe [119], who lead the Durr et al. experimental team, "*The Heisenberg Uncertainty Principle has nothing to do with wave-particle duality.*" Durr et al. report [118], "We show that the back action onto the atomic momentum implied by Heisenberg's position-momentum uncertainty relation cannot explain the loss of interference."

The Committee also erroneously argues that n=1 is justified based on Feynman's argument that the momentum of the electron in the hydrogen atom can be determined from the Uncertainty Principle. This logic is flawed and further demonstrates the Committee's lack of understanding of basic physics. The uncertainty in the momentum—not the momentum— may be determined from the Uncertainty Principle. Thus, there is no basis for the Committee's broad conclusion that the momentum of the electron in the hydrogen atom can be determined from the Uncertainty Principle.

The Committee's logic is further shown to be flawed in "The POSTULATED Schrödinger Equation Does Not Explain the Stability of the

Hydrogen Atom" section of R. Mills, The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, pp. 76-77, which states:

> Quantum theory does not say why an atom radiates. Quantum states of quantum theory refer to energy levels of probability waves. From these, emission and absorption of radiation is inferred. But quantum theory does not explain why it is emitted or absorbed or why certain states are stable. For example, the Schrödinger equation was postulated in 1926. It does not explain the stability of the hydrogen atom. To say that the atom obeys the Schrodinger equation is nonsensical. Consider the hydrogen atom without regard to the mathematical formula called the Schrodinger equation. Mathematics does not determine physics. It only models physics. The Schrodinger equation is not based on directly testable physical laws such as Maxwell's equations. It only gives correlations and is, in fact, inconsistent with physical laws.

As a historical note:

> [My father] said, "I understand that they say that light is emitted from an atom when it goes from one state to another, from an excited state to a state of lower energy."
> I said, "That's right."
> "And light is kind of a particle, a photon, I think they call it."
> "Yes."
> "So if the photon comes out of the atom when it goes from the excited to the lower state, the photon must have been in the atom in the excited state."
> I said, "Well no."
> He said, "Well, how do you look at it so you can think of a particle photon coming out without it having been there in the excited state?"
> I thought a few minutes, and I said, "I'm sorry; I don't know. I can't explain it to you."
> -Richard P. Feynman, The Physics Teacher (September 1969).

The definition of the "ground state" by outdated quantum theory is mathematically purely arbitrary. It is always experimentally observed that the hydrogen atom does not spontaneously emit light once it has achieved an energy level of 13.6 eV. Thus, it is taught in textbooks that atomic hydrogen cannot go below this ground state. But, atomic hydrogen having an experimental ground state of 13.6 eV can only exist in a vacuum or in isolation, and atomic hydrogen cannot go below this ground state only when it is in isolation. Atomic

hydrogen is extremely reactive, and there is no known composition of matter containing hydrogen in the ground state of 13.6 eV.

Since the Schrödinger equation offers no foundation for the stability of isolated atomic hydrogen, Feynman attempted to find a basis for the definition of the "ground state" in the Heisenberg Uncertainty Principle [137]. Feynman's based his derivation on the determination of the momentum as $p \approx h/a$ from the Uncertainty Principle, wherein he argues, "We need not trust our answer to within factors like 2, π, etc. We have not even defined a very precisely." The kinetic energy follows classically from the momentum, and the electrostatic energy is given classically to give the total energy as

$$E = h^2/2ma^2 - e^2/a \tag{131}$$

Feynman determined the minimum energy in order to solve for the radius of the hydrogen atom.

$$dE/da = -h^2/ma^3 + e^2/a^2 = 0 \tag{132}$$

The result is exactly the Bohr radius.

The Uncertainty Principle [138] is

$$\sigma_x \sigma_p \geq \frac{\hbar}{2} \tag{133}$$

where σ_x and σ_p are given by

$$\sigma_x^2 = \int \psi^* \left(\hat{X} - \langle x \rangle\right)^2 \psi dx \tag{134}$$

$$\sigma_p^2 = \int \psi^* \left(\hat{P} - \langle p \rangle\right)^2 \psi dx \tag{135}$$

The definition of the momentum operator in a *one dimensional* system is [138]

$$\hat{P}_x = -i\hbar \frac{d}{dx} \tag{136}$$

and the position operator is

$$\hat{X} = x \quad \text{(multiply by x)} \tag{137}$$

Based on the Uncertainty Principle, Feynman's derivation of the Bohr radius is flawed on the basis of at least five points:

1) The Uncertainty Principle gives a lower limit to the product of the uncertainty in the momentum and the position—<u>not</u> the momentum and the position. The momentum or position could be arbitrarily larger or smaller than its uncertainty. For example, quantum mechanical textbooks express the movement of the electron, and the Heisenberg Uncertainty Principle is an expression of the statistical aspects of this movement. McQuarrie [15], gives the electron speed in the $n=1$ state of hydrogen as $2.18764 \times 10^6 \, m/sec$. Remarkably, the uncertainty in the electron speed according to the Uncertainty Principle is $1.4 \times 10^7 \, m/sec$ [16] which is an order of magnitude larger than the speed and, thus, nonsensical.

2) Feynman's derivation of the Bohr radius is internally inconsistent since the kinetic

and electrostatic energies were derived <u>classically</u>; whereas, quantum mechanics and the Uncertainty Principle are not consistent with classical mechanics.

3) Feynman's derivation of the Bohr radius is internally inconsistent since the Uncertainty Principle requires uncertainty in the position and momentum. Yet, Eqs. (2.10-2.11) of Feynman (Eqs. (131-132)) can be solved to give an EXACT rather than a most probable electron position, momentum, and energy.

4) Feynman's derivation of the Bohr radius is flawed since Eq. (2.11) of Feynman (Eq. (132)) is nothing more than the Bohr force balance equation given by McQuarrie [139] and also derived by Mills [7]. Thus, this approach fails at explaining the stability of the 13.6 eV state beyond an arbitrary definition wherein "We need not trust our answer to within factors like 2, π, etc. [137]."

5) The faulty logic is compounded by the fact that the Uncertainty Principle is founded on the definition of the momentum operator given by Eq. (136) and the position operator given by Eq. (137). Thus, the Uncertainty Principle is based on the postulated Schrödinger equation and its associated postulates and descriptions of particles as probability waves. It is <u>not</u> based on physics. In fact, it is nonsensical in many physical, real-world tests, such as scattering of electrons from neutral atoms, confining electrons to atoms, confining electrons to atoms in excited states, wherein a photon causing a transition carries $\hbar$ of angular momentum, and the cosmological consequences of the Uncertainty Principle as described previously. Also, it is disproved experimentally that it provides a basis for the wave-particle duality nature of light and particles; even though, the opposite is widely touted as discussed in the "It has Been Shown Experimentally that the Heisenberg Uncertainty Principle Has Nothing to Do with Wave-Particle Duality" section.

According to the generally accepted Born interpretation of the meaning of the wavefunction, the probability of finding the electron between r, θ, ϕ and $r+dr, \theta+d\theta, \phi+d\phi$ is given by Eq. (130). The electron is viewed as a discrete particle that moves here and there (from $r=0$ to $r=\infty$), and $\Psi\Psi^*$ gives the time average of this motion. The Schrödinger equation possesses terms corresponding to the electron radial and angular kinetic energy which sum with the potential energy to give the total energy. These are necessary conditions for an electron bound by a central field [11]. Herman Haus derived a test of radiation based on Maxwell's equations [18]. Applying Haus's theorem to the point particle that must have radial kinetic energy demonstrates that the Schrödinger solution for the $n=1$ state of hydrogen is radiative; thus, it violates Maxwell's equations. Since none is observed for the $n=1$ state, QM is inconsistent with observation. The derivation is shown in the " Schrödinger Wave Functions in Violation of Maxwell's Equations" section of Mills [140].

In contrast, Applicant's modern theory is derived from Maxwell's equation with the constraint that the $n=1$ state is nonradiative. This approach leads to the prediction of stable states below the traditional $n=1$ state. Corresponding states are confirmed by the data on the free electrons in superfluid helium and other experimental test results described above.

In addition, the Uncertainty Principle is experimentally disproved since it predicts nonlocality, noncausality, spooky actions at a distance, and perpetual motion. See the "The Heisenberg Uncertainty Principle Predicts Nonlocality, Noncausality, Spooky Actions at a Distance, and Perpetual Motion which can be Shown to be Experimentally Incorrect" section of R. Mills, The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

The Uncertainty Principle is also experimentally disproved since it predicts an essentially infinite cosmological constant as given in the "Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality' section of R. Mills, The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, , Vol. 26, No. 10, (2001), pp. 1059-1096, which states:

> The Rutherford experiment demonstrated that even atoms are comprised of essentially empty space [95]. Zero-point field fluctuations, virtual particles, and states of negative energy and mass invoked to describe the vacuum are nonsensical and have no basis in reality since they have never been observed experimentally and would correspond to an essentially infinite cosmological constant throughout the entire universe including regions of no mass. As given by Waldrop [96], "What makes this problem into something more than metaphysics is that the cosmological constant is observationally zero to a very high degree of accuracy. And yet, ordinary quantum field theory predicts that it ought to be enormous, about 120 orders of magnitude larger than the best observational limit. Moreover, this prediction is almost inescapable because it is a straightforward application of the Uncertainty Principle, which in this case states that every quantum field contains a certain, irreducible amount of energy even in empty space. Electrons, photons, quarks--the quantum field of every particle contributes. And that energy is exactly equivalent to the kind of pressure described by the cosmological constant. The cosmological constant has accordingly been an embarrassment and a frustration to every physicist who has ever grappled with it."

On page 29 of the Consolidated Appendix, the Committee further incorrectly

states:

> Parenthetically, it is noted that the Schrodinger equation, in the cited description to Feynman et **al. (1965)** at pp. 19-i to 19-18, does not account for the corrections that would be expected if such factors as special relativity and the spin property of the electron were taken into account. However, the emendations introduced by consideration of the above factors account for but a _minute_ portion of the total (binding) energy of the electron in the ground state thereby confirming the _fundamentally correct_ picture of matter at the atomic level described by Schrodinger's equation.

This statement is notable for the Committee admission that the Schrodinger equation, a pillar of outdated quantum theory upon which its entire analysis is based, is flawed since it does not account for spin and special relativity.   Even more noteworthy is how the Committee now characterizes the Schrodinger equation—not as being exact as one would expect of a physical law, but rather, as being only "fundamentally correct." It is absurd that the Committee continues to rely upon an outdated theory that it admits is only "fundamentally correct" as a basis for arguing that Applicant's lower energy states cannot possibly exist and are therefore "incredible."

Applicant once again requests that the Committee look past flawed quantum theory and fairly consider the experimental evidence of record.

On pages 29-30 of the Consolidated Appendix, the Committee further incorrectly states:

> The Dirac equation accounts for both of the above mentioned factors. The equations of quantum electrodynamics go beyond even the Dirac equation in that they account for the self-energy (or self-interaction) of the electron. Moreover, there is a _logical_ development in the passage from the Schrodinger equation to the Dirac equation and, thence, to the equations of quantum electrodynamics. These issues are discussed in § 17 below.

Applicant has pointed out the many flaws in the Dirac equation throughout this and other previous Response, which stand unrebutted.

On page 30 of the Consolidated Appendix, the Committee further incorrectly states:

> It is extremely important to recognize that _even without_ the introduction of the _minute corrections_ stemming from considering special relativity and the spin of the electron, the use of the Schrodinger wave equation, as opposed to the classical wave equation, represents a _major_ departure _in_

the right direction away from purely classical ideas as substantiated by over 100 years of scientific research into the behavior of *electrons in atoms.*

Again, the Committee's admission that the Schrodinger equation requires "minute corrections" is further evidence demonstrating the many flaws of outdated quantum theory. Applicant has shown in extensive detail throughout this and other previous Responses the many flaws of the Schrodinger equation, which stand unrebutted. The Committee's mere conclusion that Schrodinger equation has been substantiated by 100 years of scientific research has no weight. The Committee conveniently ignores the 100 years of scientific research, including Applicant's experimental evidence of record, identifying the many flaws of the Schrodinger equation.

On page 30 of the Consolidated Appendix, the Committee further incorrectly states:

> The elegance and power of quantum mechanics is especially evident in its application to the simplest of atoms - the hydrogen atom. Applicant's attention is again drawn to pp. 19-1 to 19-18 in Feynman et al. (attached to the previous office actions of record) which describes the *true* properties of the hydrogen atom.

Applicant has shown throughout this Response that outdated quantum, which can only show the energy states of a one-electron atom for n=1 and greater, pales in comparison to Applicant's modern theory, which accurately predicts all energy states, including the lower energy states, of one electron atoms, as well as all other atoms and molecules. Based on the overwhelming weight of this evidence, the Committee's rejections in this case have been shown to be entirely without merit.

On page 30 of the Consolidated Appendix, the Committee further incorrectly states:

> In conclusion, it is apparent that applicant's invocation of Maxwell's equations *via* a boundary condition based on Haus's paper achieves nothing constructive since it is both erroneous and unnecessary for an electron in a stationary state and since, as stated previously, applicant's classical wave equation is simply inapplicable to a quantum mechanical system such as the hydrogen atom, It is observed that only when an electron transits from a higher energy stationary state to a lower energy

stationary state does it radiate energy having a frequency given by the difference in energy between the two states divided by Planck's constant.

Applicant's use of classical electromagnetic theory in the context of the hydrogen atom is not in accordance with the proper criteria by which one of skill in the art would have decided whether classical or quantum theory is applicable. As evidence attention is directed to Jackson (1975) at p. 4 which states that:

"The *quantum* nature of the electromagnetic radiation must, on the other hand, be taken into account in spontaneous emission of radiation by atoms, *or by any other system where there are no photons present initially and only a small number of photons present finally.*"

Since the hydrogen atom contains a proton, an electron and *no* photons initially, it is evident that quantum, *not classical,* electromagnetic theory must be employed, contrary to applicant's approach.

The Committee's arguments are nonsensical. Applicant has shown in detail how he correctly uses Maxwell's equations and Haus' condition to arrive at his modern theory that complies with classical laws. In contrast, the outdated theory the Committee clings to **violates** classical laws and, thus, does not represent reality. Applicant can find no logic in the Committee's conclusion that quantum theory, which violates classical laws, "must be employed" and not Applicant's modern theory, which is based on classical laws.

As shown previously on many occasions, Applicant once again shows in detail how he properly uses Haus' condition and Maxwell's equations:

CQM APPROACH TO THE SOLUTION OF THE ELECTRON

CQM solves the electron by a different approach than that used to solve the Schrödinger wave equation. Rather than using a postulated wave equation with time eliminated in terms of the energy of the electron in a Coulomb field and solving the charge wave (Schrödinger interpretation) or the probability wave (Born interpretation), the solution for the scalar (charge) and vector potential (current) functions of the electron are sought based on first principles. CQM first assumes that the functions that physically describe the mass and charge of the electron in space and time obey the wave equation since it conserves energy and angular momentum. The solution is initially generalized to be three dimensional plus time. Rather than use the postulated Schrödinger boundary condition: "$\Psi \to 0$ as $r \to \infty$", which leads to a purely mathematical model

of the electron, the constraint is based on the experimental observation
that the moving charge must not radiate. Application of the Haus'
condition based on Maxwell's equations to a generalized three dimension
plus time wave equation requires that the functions must be solutions of
Eq. (I.16), a two dimensional wave equation plus time. This is consistent
with first principle laws and ultimately matches experimentation. However,
it is unconventional.

The two dimensional wave equation plus time is given by
McQuarrie [2]. It is mathematically identical to the familiar rigid rotor
equation of QM. The electron is confined to two dimensions (θ and ϕ)
plus time, and the corresponding wave equation solution is called an
electron orbitsphere. Spherical harmonic functions and time harmonic
functions are well known solutions of the angular and time components of
the two dimensional wave equation plus time, respectively. The solutions
appear in McQuarrie [3]. A constant current function is also a solution of
the wave equation. A constant function corresponding to the electron spin
function is added to each of the spherical harmonic functions to give the
charge (mass)-density functions of the electron as a function of time. The
integral of a spherical harmonic function over the orbitsphere is zero. The
integral of the constant function over the orbitsphere is the total charge
(mass) of the electron. These functions comprise the well known s, p, d, f,
etc. electrons or orbitals. In the case that such an electron state arises as
an excited state by photon absorption, it is radiative due to a radial dipole
term in its current-density function since it possesses spacetime Fourier
components synchronous with waves traveling at the speed of light as
shown in the Instability of the Excited States section.

The excited states are solved including the radii of the orbitspheres
using Maxwell's equations with the traditional source current boundary
constraints at the electron. Quantization arises from the equation of the
photon and the electron—not from the solution of the electron alone. After
all, each solution models an excited state created by the absorption of a
photon. The solutions are analogous to those of excited resonator modes
except that the cavity is dynamic. The field lines from the proton end on
the current-density function of the electron, and the electric field is zero for
$r > r_n$. The trapped photons are a solution of the three dimensional wave
equation plus time given by Maxwell's equations. The electrodynamic field
of the photon is a constant function plus a time and spherical harmonic
function that is in phase with source currents at the electron which is given
by a constant plus a time and spherical harmonic function. Only particular
solutions are possible as resonant photons of the electron which is a
dynamic resonator cavity. The results are in agreement with first principle
physics and experimental observations of the hydrogen atom, excited
states, free electron, and free space photon including the wave particle

duality aspects.

SPIN AND ORBITAL PARAMETERS ARISE FROM FIRST PRINCIPLES

An electron is a spinning, two-dimensional spherical surface, called an *electron orbitsphere*, that can exist in a bound state only at specific radii r_n from the nucleus. (See Figure 1.1 for a pictorial representation of an orbitsphere.) The result for the $n = 1$ state of hydrogen is that the charge-density function remains constant with each point on the surface moving at the same angular and linear velocity. The constant function solution of the two dimensional wave equation corresponds to the spin function which has a corresponding spin angular momentum that may be calculated from $\mathbf{r} \times \mathbf{p}$ applied directly to the current-density function that describes the electron. The radius of the nonradiative ($n = 1$) state is solved using the electromagnetic force equations of Maxwell relating the charge and mass-density functions wherein the angular momentum of the electron is $\hbar$ (Eq. (1.165)). The reduced mass arises naturally from an electrodynamic interaction between the electron and the proton rather than from a point mass revolving around a point nucleus in the case of Schrödinger wave equation solutions which presents an internal inconsistency since the wave functions are spherically symmetrical.

CQM gives closed form solutions for the resonant photons and excited state electron functions. The free space photon also comprises a radial Dirac delta function, and the angular momentum of the photon given by $\mathbf{m} = \int \frac{1}{8\pi c} \mathrm{Re}[\mathbf{r} \times (\mathbf{E} \times \mathbf{B}^*)] dx^4 = \hbar$ in the Photon section is conserved for the solutions for the resonant photons and excited state electron functions. It can be demonstrated that the resonance condition between these frequencies is to be satisfied in order to have a net change of the energy field [4]. In the present case, the correspondence principle holds. That is the change in angular frequency of the electron is equal to the angular frequency of the resonant photon that excites the resonator cavity mode corresponding to the transition, and the energy is given by Planck's equation. The predicted energies, Lamb shift, fine structure splitting, hyperfine structure, resonant line shape, line width, selection rules, etc. are in agreement with observation.

The radii of excited states are solved using the electromagnetic force equations of Maxwell relating the field from the charge of the proton, the electric field of the photon, and charge and mass-density functions of the electron wherein the angular momentum of the electron is $\hbar$ (Eq. (1.165)).

For excited states of the hydrogen atom, the constant function

solution of the two dimensional wave equation corresponds to the spin function. Each spherical harmonic function modulates the constant spin function and corresponds to an orbital function of a specific excited state with a corresponding phase-matched trapped photon and orbital angular momentum. Thus, the spherical harmonic function behaves as a charge-density wave which travels time harmonically on the surface of the orbitsphere about a specific axis. (See Figure 1.2 for a pictorial representation.) The amplitude of the corresponding orbital energy may be calculated from Maxwell's equations. Since the constant function is modulated harmonically, the time average of the orbital energy is zero except in the presence of a magnetic field. Nondegeneracy of energy levels arises from spin, orbital, and spin-orbital coupling interactions with the applied field. The electrodynamic interaction with the magnetic field gives rise to the observed hyperfine splitting of the hydrogen spectrum.

Many inconsistencies arise in the case of the corresponding solutions of the Schrödinger wave equation. For example, where is the photon in excited states given by the Schrödinger equation? And, a paradox arises for the change in angular momentum due to photon absorption. The Schrödinger equation solutions for the kinetic energy of rotation K_{rot} is given by Eq. (10) of ref. [5] and the value of the electron angular momentum L for the state $Y_{lm}(\theta,\phi)$ is given by Eq. (11) of ref. [5]. They predict that the excited state rotational energy levels are nondegenerate as a function of the ℓ quantum number even in the absence of an applied magnetic field, and the predicted energy is over six orders of magnitude of the observed nondegenerate energy in the presence of a magnetic field. In the absence of a magnetic field, no preferred direction exists. In this case, the ℓ quantum number is a function of the orientation of the atom with respect to an arbitrary coordinate system. Therefore, the nondegeneracy is nonsensical and violates conservation of angular momentum of the photon.

In quantum mechanics, the spin angular momentum of the electron is called the "intrinsic angular momentum" since no physical interpretation exists. The Schrödinger equation is not Lorentzian invariant in violation of special relativity. It fails to predict the results of the Stern-Gerlach experiment which indicates the need for an additional quantum number. Quantum Electrodynamics (QED) was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. It is fatally flawed. From Weisskopf [6], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; 1.) DOES NOT EXPLAIN NONRADIATION OF BOUND

ELECTRONS; 2.) contains an internal inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite (the Schrödinger equation fails to predict the classical electron radius); 3.) it admits solutions of negative rest mass and negative kinetic energy; 4.) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; 5.) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. Dirac's equation which was postulated to explain spin relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors. All of these features are untenable or are inconsistent with observation. These problems regarding spin and orbital angular momentum and energies and the classical electron radius are nonexistent with CQM solutions.

Furthermore, the mathematical relationship whereby the Schrödinger equation may be transformed into a form consistent with first principles is shown *infra*. In the case that the potential energy of the Hamiltonian, H, is a constant times the wavenumber, the Schrödinger equation is the well known Bessel equation. Then one of the solutions for the wavefunction Ψ (a current-density function rather than a probability wave) is equivalent to an inverse Fourier transform. According to the duality and scale change properties of Fourier transforms, the energy equation of CQM and that of quantum mechanics are identical, the energy of a radial Dirac delta function of radius equal to an integer multiple of the radius of the hydrogen atom.

CLASSICAL QUANTUM THEORY

One-electron atoms include the hydrogen atom, He^+, Li^{2+}, Be^{3+}, and so on. The mass-energy and angular momentum of the electron are constant; this requires that the equation of motion of the electron be temporally and spatially harmonic. Thus, the classical wave equation applies and

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]\rho(r,\theta,\phi,t) = 0 \tag{I.2}$$

where $\rho(r,\theta,\phi,t)$ is the charge-density function of the electron in time and space. In general, the wave equation has an infinite number of solutions. To arrive at the solution which represents the electron, a suitable boundary condition must be imposed. It is well known from experiments that each single atomic electron of a given isotope radiates to the same stable state. Thus, CQM uses the physical boundary condition of nonradiation of the bound electron to be imposed on the solution of the wave equation for the charge-density function of the electron. The condition for radiation by a moving point charge given by Haus [7] is that

its spacetime Fourier transform possesses components that are synchronous with waves traveling at the speed of light. Conversely, it is proposed that the condition for nonradiation by an ensemble of moving point charges that comprises a charge-density function is

For non-radiative states, the current-density function must NOT possess spacetime Fourier components that are synchronous with waves traveling at the speed of light.

The Haus derivation applies to a moving charge-density function as well because charge obeys superposition. The Haus derivation is summarized below.

The Fourier components of the current produced by the moving charge are derived. The electric field is found from the vector equation in Fourier space (k, ω-space). The inverse Fourier transform is carried over the magnitude of k. The resulting expression demonstrates that the radiation field is proportional to $J_\perp(\frac{\omega}{c}\mathbf{n}, \omega)$, where $J_\perp(\mathbf{k}, \omega)$ is the spacetime Fourier transform of the current perpendicular to k and $\mathbf{n} \equiv \frac{\mathbf{k}}{|k|}$. Specifically,

$$E_\perp(\mathbf{r},\omega)\frac{d\omega}{2\pi} = \frac{c}{2\pi}\int\rho(\omega,\Omega)d\omega d\Omega\sqrt{\frac{\mu_0}{\varepsilon_0}}\mathbf{n}\,X\left(\mathbf{n}\,X\mathbf{J}_\perp\left(\frac{\omega}{c}\mathbf{n},\omega\right)e^{i\left(\frac{\omega}{c}\right)\mathbf{n}\cdot\mathbf{r}}\right) \quad (1.3)$$

The field $E_\perp(\mathbf{r},\omega)\frac{d\omega}{2\pi}$ is proportional to $J_\perp\left(\frac{\omega}{c}\mathbf{n},\omega\right)$, namely, the Fourier component for which $\mathbf{k} = \frac{\omega}{c}$. Factors of ω that multiply the Fourier component of the current are due to the density of modes per unit volume and unit solid angle. An unaccelerated charge does not radiate in free space, not because it experiences no acceleration, but because it has no Fourier component $J_\perp\left(\frac{\omega}{c}\mathbf{n},\omega\right)$. (Nonradiation is also shown directly using Maxwell's equations in Appendix I: Nonradiation Based on the Electromagnetic Fields and the Poynting Power Vector.)

The time, radial, and angular solutions of the wave equation are separable. The motion is time harmonic with frequency ω_n. To be a harmonic solution of the wave equation in spherical coordinates, the angular functions must be spherical harmonic functions. A zero of the spacetime Fourier transform of the product function of two spherical harmonic angular functions, a time harmonic function, and an unknown radial function is sought. The solution for the radial function which satisfies the boundary condition is a delta function

$$f(r) = \frac{1}{r^2}\delta(r - r_n)$$ (I.4)

where $r_n = nr_1$ is an allowed radius. Thus, bound electrons are described by a charge-density (mass-density) function which is the product of a radial delta function ($f(r) = \frac{1}{r^2}\delta(r - r_n)$), two angular functions (spherical harmonic functions), and a time harmonic function. Thus, an electron is a spinning, two-dimensional spherical surface, called an *electron orbitsphere*, that can exist in a bound state at only specified distances from the nucleus as shown in Figure 1.1. More explicitly, the orbitsphere comprises a two-dimensional spherical shell of moving charge.

The total function that describes the spinning motion of each electron orbitsphere is composed of two functions. One function, the spin function, is spatially uniform over the orbitsphere, spins with a quantized angular velocity, and gives rise to spin angular momentum. The other function, the modulation function, can be spatially uniform—in which case there is no orbital angular momentum and the magnetic moment of the electron orbitsphere is one Bohr magneton—or not spatially uniform—in which case there is orbital angular momentum. The modulation function also rotates with a quantized angular velocity.

The uniform current density function $Y_0^0(\phi, \theta)$, the orbitsphere equation of motion of the electron (Eqs. (1.64-1.65)), corresponding to the constant charge function of the orbitsphere that gives rise to the spin of the electron is generated from a basis set current-vector field defined as the orbitsphere current-vector field ("orbitsphere-cvf"). This in turn is generated from orthogonal great circle current loops that serve as basis elements. In Appendix III, the *continuous* uniform electron current density function $Y_0^0(\phi, \theta)$ (Eqs. (1.64-1.65)) is then exactly generated from this orbitsphere-cvf as a basis element by a convolution operator comprising an autocorrelation-type function.

The orbitsphere-cvf comprises an infinite series of correlated orthogonal great circle current loops. The current pattern is generated over the surface by two sets of an infinite series of nested rotations of two orthogonal great circle current loops where the coordinate axes rotate with the two orthogonal great circles. Each infinitesimal rotation of the infinite series is about the new i'-axis and new j'-axis which results from the preceding such rotation. For each of the two sets of nested rotations, the angular sum of the rotations about each rotating i'-axis and j'-axis totals $\frac{\sqrt{2}}{2}\pi$ radians.

Consider the electron to be evenly distributed within two sets of orthogonal great circle current loops for Steps One and Two. Then, consider two infinitesimal point mass (charge)-density elements, one and

two, of one set of two orthogonal great circle current loops wherein initially the first current loop lies in the yz-plane, and the second current loop lies in the xz-plane. The xyz Cartesian coordinate frame is designated the laboratory reference frame. The algorithm to generate the orbitsphere-cvf rotates the great circles and the corresponding coordinates relative to the xyz frame. A primed Cartesian coordinate system refers to the axes that rotate with the great circles and determines the basis-set reference frame. Each element of the current pattern is obtained with each conjugate set of rotations. For Step One, consider two such infinitesimal charges (masses) at points one (moving counter clockwise on the great circle in the y'z'-plane) and two (moving clockwise on the great circle in the x'z'-plane) of two orthogonal great circle current loops in the basis frame are considered as sub-basis elements to generate the current density corresponding to the spin quantum number, $s = \frac{1}{2}$; $m_s = \pm\frac{1}{2}$. Initially element one is at $x' = 0$, $y' = 0$, and $z' = r_n$ and element two is at $x' = r_n$, $y' = 0$, and $z' = 0$ as shown in Figure 1.4A. The equations of motion, in the sub-basis-set reference frame are given by

point one:

$$x_1' = 0 \qquad y_1' = -r_n\sin(\omega_n t) \qquad z_1' = r_n\cos(\omega_n t) \qquad \text{(I.5a)}$$

point two:

$$x_2' = r_n\cos(\omega_n t) \qquad y_2' = 0 \qquad z_2' = r_n\sin(\omega_n t) \qquad \text{(I.5b)}$$

For Step Two, consider two charge (mass)-density elements, point one and two, in the basis-set reference frame at time zero. Element one is at $x' = 0$, $y' = r_n$, and $z' = 0$ and element two is at $x' = r_n$, $y' = 0$, and $z' = 0$. Let element one move clockwise on a great circle toward the -z'-axis as shown in Figure 1.4B, and let element two move counter clockwise on a great circle toward the y'-axis as shown in Figure 1.4B. The equations of motion, in the basis-set reference frame are given by

point one:

$$x_1' = 0 \qquad y_1' = r_n\cos(\omega_n t) \qquad z_1' = -r_n\sin(\omega_n t) \qquad \text{(I.6a)}$$

point two:

$$x_2' = r_n\cos(\omega_n t) \qquad y_2' = r_n\sin(\omega_n t) \qquad z_2' = 0 \qquad \text{(I.6b)}$$

The great circles are rotated by an infinitesimal angle $\pm\Delta\alpha_i$ (a rotation around the x'-axis or z'-axis for Steps One and Two, respectively) and then by $\pm\Delta\alpha_j$ (a rotation around the new y'-axis or x'-axis for Steps One and Two, respectively) where the rotation directions are shown in Figures 1.4A and 1.4B, respectively. The coordinates of each point on each rotated great circle (x',y',z') is expressed in terms of the first (x,y,z) coordinates by the following transforms where clockwise rotations are defined as positive:

Step One

$$
\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & 0 & -\sin(\Delta\alpha_y) \\ 0 & 1 & 0 \\ \sin(\Delta\alpha_y) & 0 & \cos(\Delta\alpha_y) \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}
$$

$$
\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_y) & \sin(\Delta\alpha_y)\sin(\Delta\alpha_x) & -\sin(\Delta\alpha_y)\cos(\Delta\alpha_x) \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_y) & -\cos(\Delta\alpha_y)\sin(\Delta\alpha_x) & \cos(\Delta\alpha_y)\cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}
$$

(I.7)

Step Two

$$
\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\Delta\alpha_x) & \sin(\Delta\alpha_x) \\ 0 & -\sin(\Delta\alpha_x) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\sin(\Delta\alpha_z) & \cos(\Delta\alpha_z) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}
$$

$$
\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha_z) & \sin(\Delta\alpha_z) & 0 \\ -\cos(\Delta\alpha_x)\sin(\Delta\alpha_z) & \cos(\Delta\alpha_x)\cos(\Delta\alpha_z) & \sin(\Delta\alpha_x) \\ \sin(\Delta\alpha_x)\sin(\Delta\alpha_z) & -\sin(\Delta\alpha_x)\cos(\Delta\alpha_z) & \cos(\Delta\alpha_x) \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}
$$

(I.8)

where the angular sum is $\displaystyle \lim_{\Delta\alpha \to 0} \sum_{n=1}^{\frac{\frac{\sqrt{2}}{2}\pi}{|\Delta\alpha_{i,j}|}} |\Delta\alpha_{i,j}| = \frac{\sqrt{2}}{2}\pi$.

The orbitsphere-cvf is given by n reiterations of Eqs. (I.7) and (I.8) for each point on each of the two orthogonal great circles during each of Steps One and Two where the sign of $\pm\Delta\alpha_i$ and $\pm\Delta\alpha_j$ for each Step are given in Table 1.1. The output given by the non-primed coordinates is the input of the next iteration corresponding to each successive nested rotation by the infinitesimal angle $\pm\Delta\alpha_i$ or $\pm\Delta\alpha_j$ where the magnitude of the angular sum of the n rotations about each of the i'-axis and the j'-axis is $\frac{\sqrt{2}}{2}\pi$. Half of the orbitsphere-cvf is generated during each of Steps One and Two.

Following Step Two, in order to match the boundary condition that the magnitude of the velocity at any given point on the surface is given by Eq. (1.56), the output half of the orbitsphere-cvf is rotated clockwise by an angle of $\frac{\pi}{4}$ about the z-axis. Using Eq. (I.8) with $\Delta\alpha_z = \frac{\pi}{4}$ and $\Delta\alpha_x = 0$ gives the rotation. Then, the one half of the orbitsphere-cvf generated from Step One is superimposed with the complementary half obtained from Step Two following its rotation about the z-axis of $\frac{\pi}{4}$ to give the orbitsphere-cvf.

The current pattern of the orbitsphere-cvf generated by the nested rotations of the orthogonal great circle current loops is a continuous and total coverage of the spherical surface, but it is shown as visual

representations using 6 degree increments of the infinitesimal angular variable $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ of Eqs. (I.7) and (I.8) from six perspectives in Figures 1.5A-F. In each case, the complete orbitsphere-cvf current pattern corresponds to all the correlated points, points one and two, of the orthogonal great circles shown in Figures 1.4A and 1.4B which are rotated according to Eqs. (I.7) and (I.8) where $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ approach zero and the summation of the infinitesimal angular rotations of $\pm\Delta\alpha_{i'}$ and $\pm\Delta\alpha_{j'}$ about the successive i'-axes and j'-axes is $\dfrac{\sqrt{2}}{2}\pi$ for each Step. The current pattern gives rise to the phenomenon corresponding to the spin quantum number.

The resultant angular momentum projections of $L_{xy} = \dfrac{\hbar}{4}$ and $L_z = \dfrac{\hbar}{2}$ meet the boundary condition for the unique current having an angular velocity magnitude at each point on the surface given by Eq. (1.56) and give rise to the Stern Gerlach experiment as shown in the Magnetic Parameters of the Electron (Bohr Magneton) section, and in the Electron g Factor section. The further constraint that the current density is uniform such that the charge density is uniform, corresponding to an equipotential, minimum energy surface is satisfied by using the orbitsphere-cvf as a basis element to generate $Y_0^0(\phi,\theta)$ using a convolution operator comprising an autocorrelation-type function as given in Appendix III. The operator comprises the convolution of each great circle current loop of the orbitsphere-cvf designated as the primary orbitsphere-cvf with a second orbitsphere-cvf designated as the secondary orbitsphere-cvf.

The orbitsphere-cvf comprises two components corresponding to each of STEP ONE and STEP TWO. As shown for STEP TWO, the angular momentum vector is stationary on the $\left(-\dfrac{1}{\sqrt{2}}\,i_x, \dfrac{1}{\sqrt{2}}\,i_y, i_z\right)$-axis as the component orbitsphere-cvf is generated by the series of nested rotations using Eq. (1.70b). It is shown in Appendix III that STEP TWO can also be generated by a 2π-rotation of a single basis-element current loop about the $\left(-\dfrac{1}{\sqrt{2}}\,i_x, \dfrac{1}{\sqrt{2}}\,i_y, i_z\right)$-axis. In the general case that the resultant angular momentum of each pair of orthogonal great circle current loops of the component orbitsphere-cvf is along the 2π-rotational axis (defined as the rotational axis which generates the component orbitsphere-cvf from a basis-element great circle), a secondary nth component orbitsphere-cvf can serve as a basis element to match the angular momentum of any given nth great circle of a primary component orbitsphere-cvf. The replacement of each great circle of the primary orbitsphere-cvf with a secondary orbitsphere-cvf of matching angular momentum, orientation,

and phase comprises an autocorrelation-type function that exactly gives rise to the spherically-symmetric current density, $Y_0^0(\phi,\theta)$, as the sum of two uniform spherical contributions from each component. The resulting exact uniform current distribution obtained from the convolution has the same angular momentum distribution, resultant, $\mathbf{L_R}$, and components of $\mathbf{L}_{xy} = \dfrac{\hbar}{4}$ and $\mathbf{L}_z = \dfrac{\hbar}{2}$ as those of the orbitsphere-cvf used as a primary basis element.

In contrast to the QM and QED cases (See Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality), the fourth quantum number arises naturally in CQM as derived in the Electron g Factor section. The Stern-Gerlach experiment implies a magnetic moment of one Bohr magneton and an associated angular momentum quantum number of 1/2. Historically, this quantum number is called the spin quantum number, s ($s = \dfrac{1}{2}$; $m_s = \pm\dfrac{1}{2}$). Conservation of angular momentum of the orbitsphere permits a discrete change of its "kinetic angular momentum" ($\mathbf{r} \times m\mathbf{v}$) with respect to the field of $\dfrac{\hbar}{2}$, and concomitantly the "potential angular momentum" ($\mathbf{r} \times e\mathbf{A}$) must change by $-\dfrac{\hbar}{2}$. The flux change, ϕ, of the orbitsphere for $r < r_n$ is determined as follows:

$$\Delta\mathbf{L} = \frac{\hbar}{2} - \mathbf{r} \times e\mathbf{A} \qquad (I.9)$$

$$= \left[\frac{\hbar}{2} - \frac{e2\pi rA}{2\pi}\right]\hat{z} \qquad (I.10)$$

$$= \left[\frac{\hbar}{2} - \frac{e\phi}{2\pi}\right]\hat{z} \qquad (I.11)$$

In order that the change of angular momentum, $\Delta\mathbf{L}$, equals zero, ϕ must be $\Phi_0 = \dfrac{h}{2e}$, the magnetic flux quantum. Thus, to conserve angular momentum in the presence of an applied magnetic field, the orbitsphere magnetic moment can be parallel or antiparallel to an applied field as observed with the Stern-Gerlach experiment, and the flip between orientations is accompanied by the "capture" of the magnetic flux quantum by the orbitsphere. During the spin-flip transition, power must be conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \cdot (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o\mathbf{H} \cdot \mathbf{H}\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o\mathbf{E} \cdot \mathbf{E}\right] - \mathbf{J} \cdot \mathbf{E} \qquad (I.12)$$

Eq. (I.13) derived in the Electron g Factor section gives the total energy of the flip transition which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric

energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively.

$$\Delta E_{mag}^{spin} = 2\left(1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2\right)\mu_B B \qquad (\text{I.13})$$

$$\Delta E_{mag}^{spin} = g\mu_B B \qquad (\text{I.14})$$

The spin-flip transition can be considered as involving a magnetic moment of g times that of a Bohr magneton. The g factor is redesignated the fluxon g factor as opposed to the anomalous g factor. The calculated value of $\frac{g}{2}$ is 1.001 159 652 137. The experimental value [8] of $\frac{g}{2}$ is 1.001 159 652 188(4).

CQM solves the wave equation for the charge-density function of the electron. The time, radial, and angular solutions of the wave equation are separable. Also, the radial function for the electron indicates that the electron is two-dimensional. Therefore, the angular mass-density function of the electron, $A(\theta, \phi, t)$, must be a solution of the wave equation in two dimensions (plus time). EQ. (I.2) becomes

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]A(\theta, \phi, t) = 0 \qquad (\text{I.15})$$

where $\rho(r, \theta, \phi, t) = f(r)A(\theta, \phi, t) = \frac{1}{r^2}\delta(r - r_n)A(\theta, \phi, t)$ and

$A(\theta, \phi, t) = Y(\theta, \phi)k(t)$. Specifically, the wave equation is

$$\left[\frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial}{\partial\theta}\right)_{r,\phi} + \frac{1}{r^2\sin^2\theta}\left(\frac{\partial^2}{\partial\phi^2}\right)_{r,\theta} - \frac{1}{v^2}\frac{\partial^2}{\partial t^2}\right]A(\theta, \phi, t) = 0 \quad (\text{I.16})$$

where v is the linear velocity of the electron. The charge-density functions including the time-function factor are

$\ell = 0$

$$\rho(r, \theta, \phi, t) = \frac{e}{8\pi r^2}[\delta(r - r_n)]\left[Y_0^0(\theta, \phi) + Y_\ell^m(\theta, \phi)\right] \qquad (\text{I.17})$$

$\ell \neq 0$

$$\rho(r, \theta, \phi, t) = \frac{e}{4\pi r^2}[\delta(r - r_n)]\left[Y_0^0(\theta, \phi) + \text{Re}\{Y_\ell^m(\theta, \phi)e^{i\omega_n t}\}\right] \qquad (\text{I.18})$$

where $\text{Re}\{Y_\ell^m(\theta, \phi)e^{i\omega_n t}\} = P_\ell^m(\cos\theta)\cos(m\phi + \omega_n' t)$ and to keep the form of the spherical harmonic as a traveling wave about the z-axis, $\omega_n' = m\omega_n$.

The spin function of the electron (see Figure 1.1 for the charge function and Figure 1.5A for the current function) corresponds to the nonradiative $n = 1$, $\ell = 0$ state of atomic hydrogen which is well known as an s state or orbital. The constant spin function is modulated by a time

and spherical harmonic function as given by Eq. (I.18) and shown in Figure 1.2. The modulation or traveling charge-density wave corresponds to an orbital angular momentum in addition to a spin angular momentum. These states are typically referred to as p, d, f, etc. orbitals and correspond to an ℓ quantum number not equal to zero. Application of the condition from Haus [7] (Eqs, (I.19-I.21)) also predicts nonradiation for a constant spin function modulated by a time and spherically harmonic orbital function. There is acceleration without radiation. (Also see Abbott and Griffiths and Goedecke [9-10]). Nonradiation is also shown directly using Maxwell's equations in Appendix I: Nonradiation Based on the Electromagnetic Fields and the Poynting Power Vector. However, in the case that such a state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current-density function since it possesses spacetime Fourier transform components synchronous with waves traveling at the speed of light as shown in the Instability of Excited States section.

The Fourier transform of the electron charge-density function is a solution of the four-dimensional wave equation in frequency space (**k**, ω-space). Then the corresponding Fourier transform of the current-density function $K(s,\Theta,\Phi,\omega)$ is given by multiplying by the constant angular frequency.

$$K(s,\Theta,\Phi,\omega) = 4\pi\omega_n \frac{\sin(2s_n r_n)}{2s_n r_n} \otimes 2\pi \sum_{\upsilon=1}^{\infty} \frac{(-1)^{\upsilon-1}(\pi\sin\Theta)^{2(\upsilon-1)}}{(\upsilon-1)!(\upsilon-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(\upsilon+\frac{1}{2}\right)}{(\pi\cos\Theta)^{2\upsilon+1}2^{\upsilon+1}} \frac{2\upsilon!}{(\upsilon-1)!} s^{-2\upsilon}$$

$$\otimes 2\pi \sum_{\upsilon=1}^{\infty} \frac{(-1)^{\upsilon-1}(\pi\sin\Phi)^{2(\upsilon-1)}}{(\upsilon-1)!(\upsilon-1)!} \frac{\Gamma\left(\frac{1}{2}\right)\Gamma\left(\upsilon+\frac{1}{2}\right)}{(\pi\cos\Phi)^{2\upsilon+1}2^{\upsilon+1}} \frac{2\upsilon!}{(\upsilon-1)!} s^{-2\upsilon} \frac{1}{4\pi}[\delta(\omega-\omega_n)+\delta(\omega+\omega_n)]$$

$$(I.19)$$

The motion on the orbitsphere is angular; however, a radial component exists due to special relativistic effects. Consider the radial wave vector of the sinc function. When the radial projection of the velocity is c

$$\mathbf{s}_n \bullet \mathbf{v}_n = \mathbf{s}_n \bullet \mathbf{c} = \omega_n \qquad (I.20)$$

the relativistically corrected wavelength is

$$r_n = \lambda_n \qquad (I.21)$$

(i.e. the lab frame motion in the angular direction goes to zero as the velocity approaches the speed of light). Substitution of Eq. (I.21) into the sinc function results in the vanishing of the entire Fourier transform of the current-density function. Thus, spacetime harmonics of $\dfrac{\omega_n}{c} = k$ or

$\dfrac{\omega_n}{c}\sqrt{\dfrac{\varepsilon}{\varepsilon_o}} = k$ for which the Fourier transform of the current-density function

is nonzero do not exist. Radiation due to charge motion does not occur in any medium when this boundary condition is met.

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This evidence stands unrebutted by the Committee.

On pages 32-34 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant's derivation of energy states of the "hydrino atom" which are characterized by *fractional* quantum numbers *(1/n,* where *n = 2, 3, ...)* has *no proper scientific or mathematical basis.* The examiner had raised this issue in the previous office action. The present amendment does *not* respond to this other than to set forth a *conclusionary* statement that makes *no mention of the details* of the mathematical steps and the scientific basis for obtaining such improper fractional quantum numbers. See p. 60 of the amendment. Given the applicant's silence on this crucial

issue, the examiner referred to applicant's book, in attachment 16, to again find only conclusionary statements. As evidence, pp. 20, 83 and 147 in the book (the 1999 edition) are cited.

On the other hand, applicant has criticized the solutions of the Schrodinger equation which permit *only positive integer values for the principal quantum number, n*. Applicant's position is that "[t]hose skilled in the art, however, readily understand that the Schrodinger equation provides an infinite number of solutions, most of which are not even integers. Positive integer solutions are only obtained by arbitrarily defining a parameter in the Schrodinger equation." See pp. 15-16 in the amendment.

Applicant's argument is deemed to be lacking in scientific merit. As evidence applicant is directed to "Endnote **1**" **in the Appendix** attached to the previous office action and also attached herein for applicant's convenience. It is observed that *not every mathematically possible solution to the Schrodinger equation leads to a physically meaningful description.* In solving Schrodinger's differential equation for the wave function of an electron in the hydrogen atom a divergent series (i.e. a scientifically meaningless) solution for the wave function is obtained for large values of the radial coordinate (where common sense suggests that the electron in the *ground* state of the hydrogen atom is less likely to be found) *unless the principal quantum number n is constrained to be a positive natural integer (n_ 1),* not a fraction of an integer as alleged by the applicant. This holds true whether the differential equation is solved directly by a power series solution as shown in Pauling and Wilson (1985) on pp. 121-124 and 140 and as previously set forth by the examiner in Endnote I of the previous office action, or, whether the differential equation is transformed into a confluent hypergeometric equation such as Whittaker's equation whose solution can be expressed in terms of the associated Laguerre functions, $e\sim^{12}g^1L\sim\div7\sim(g)$, as shown in Jeffreys and Jeffreys (1950) at p. 618 between equations (6) and(7).

Further support is found in Margenau and Murphy (1943), at pages 77-78, from which it is evident that when *n* is not a positive integer but any constant *p* then a *physically* *meaningful* solution *cannot* be expressed as $\sim$ $L\sim(x)$. The reason for this is very simple, *viz., when n is not a positive integer* then, according to Margenau and Murphy themselves at p. 78 *op. cit.,*

> "this solution would no longer be a polynomial in x mult4ilied by e"^{2} but an infinite sequence." Emphasis added.

Such an infinite sequence, which has *nonphysical significance,* stems from *n* being anything other than a positive integer, such as the fractional

integer espoused by applicant. It does *not* provide for *a physically meaningful solution to the Schrodinger equation.* Consequently, it is clear that the use of fractional quantum numbers can only produce unscientific results.

To summarize, in the cited endnote of the previous office action, the examiner stated that it is the imposition of a boundary condition requiring the wave function to have a proper asymptotic behavior at infinity, i.e. the wave function must be finite there, that causes truncation of the infinite power series expansion for the wave function to a finite polynomial solution and at the same time the truncation leads to only *positive integer values* for the principal quantum number *n*. There is *nothing arbitrary about such a well-defined mathematical procedure that produces a correct solution for the hydrogen atom.* For a complete exposition of the *proper* mathematical procedure for solving the Schrödinger equation see Pauling and Wilson (1985) at pp. 121 to 124, 140 and Feynman et al. (1965) at pp. 19-1 to 19-18 attached to the Appendix in the previous office action. In view of the above discussion, it is apparent that the fractional integer energy levels of the "hydrino atom" have no proper basis. [Footnote omitted.]

It follows from the above discussion that since there is no support for the existence of fractional integer levels such as, e.g. $n = 1/2$, in the hydrogen atom, the applicant's statement, at p. 61 of his amendment, that "a transition between two nonradiative states is *possible via* a nonradiative energy transfer, say $n = 1$ to $n = 1/2$" has no scientific merit.

As stated previously, the physics and mathematics of the hydrino states are given in Mills GUT Chps. 5 and 6. An outline of the physics and mathematics of the hydrino states with supporting data excerpted from the paper

113. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", New Journal of Physics, submitted.

follows:

II. Hydrino States

A. Extension of the Rydberg States to Lower Levels

For a spherical resonator cavity, the nonradiative boundary condition and the

relationship between the electron and the photon give the "allowed" hydrogen energy states which are quantized as a function of the parameter n. That is the nonradiative boundary condition and the relationship between an allowed radius and the photon standing wave wavelength (Eq. (92)) gives rise to Eq. (93), the boundary condition for allowed radii and allowed electron wavelengths as a function of the parameter n. Each value of n corresponds to an allowed transition effected by a resonant photon which excites the transition in the orbitsphere resonator cavity. In addition to the traditional integer values (1, 2, 3,....,) of n, values of fractions are allowed by Eq. (93) which correspond to transitions with an increase in the central field and decrease in the radius of the orbitsphere. This occurs, for example, when the orbitsphere couples to another resonator cavity which can absorb energy. This is the absorption of an energy hole by the hydrogen atom. The absorption of an energy hole destroys the balance between the centrifugal force and the increased central electric force. Consequently, the electron undergoes a transition to a stable lower energy state. Thus, the corresponding reaction from an initial energy state to a lower energy state requiring an energy hole is called a transition reaction.

From energy conservation, the energy hole of a hydrogen atom which excites resonator modes of radial dimensions $\dfrac{a_H}{m+1}$ is

$$m \cdot 27.2 \ eV, \tag{214}$$

where $m = 1, 2, 3, 4, ...$

After resonant absorption of the energy hole, the radius of the orbitsphere, a_H, shrinks to $\dfrac{a_H}{m+1}$ and after t cycles of transition, the radius is $\dfrac{a_H}{mt+1}$. In other words, the radial ground state field can be considered as the superposition of Fourier components. The removal of negative Fourier components of energy $m \cdot 27.2 \ eV$, where m is an integer increases the positive electric field inside the spherical shell by m times the charge of a proton. The resultant electric field is a time harmonic solution of Laplace's Equations in spherical coordinates. In this case, the radius at which force balance and nonradiation are achieved is $\dfrac{a_H}{m+1}$ where m is an integer. In decaying to this radius from the "ground" state, a total energy of $[(m+1)^2 - 1^2] X 13.6 \ eV$ is released.

The increased-binding-energy hydrogen atom is called a *hydrino atom* having a binding energy of

$$Binding\ Energy = \frac{13.6\ eV}{n^2} \tag{215}$$

where

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p} \tag{216}$$

and p is an integer greater than 1. Hydrino atoms are designated as $H\left[\frac{a_H}{p}\right]$ where a_H is the radius of the hydrogen atom. The potential energy diagram of the hydrogen is extended to lower Rydberg states as given in Figure 30.

Thus, the Committee is simply wrong.

On page 35 of the Consolidated Appendix, the Committee commits further error in stating:

> **Applicant's use of a Dirac delta function, 8** *(r-r,),* to represent the radial function, and thus also the charge density which, according to applicant, is directly related to the radial function, of an electron (see p. 3 of his book as well as equation (39) as cited on p. 55 of the amendment) is scientifically improper. The reason for this is that the Dirac delta function has *no* physical significance in and of itself. It is a limit of integrals of a sequence and is *meaningful on/v under an integral sign.* That is:
>
> [equation omitted]
>
> where *5(r), 5(r) and f(r)* are a Dirac delta function, a delta sequence function and a proper test function, respectively. To make matters more difficult, it turns out that the integral on the left-hand side of the above equation is *not* a usual integral in the Riemannian sense. See Arfken (1970) at p. **415,** equation (8.85b).
>
> An example of a delta sequence function is
>
> *b%r)* = (sin *nr')/irr.*
>
> See Arfken at p. 414, equation (8.83d). Since the Dirac delta function is a "singular" function it cannot, strictly speaking, be "plotted." However, the delta sequence function above can certainly be graphed as shown in Fig. 8.3d on attached p. 414 from Arfken. The mathematical underpinning for

the Dirac delta function is provided by the Theory of Distributions (due to
L. Schwartz, *Thlorie des distributions,* Paris, **1951**) where the delta
function arises as a generalized function or functional. See Arfken at p.
415. It is apparent, based on the above discussion, that mathematical
manipulations involving the Dirac delta function are so delicate that it is
very easy to be led astray.

Whether the Dirac delta function is "delicate" or not is irrelevant. Applicant has
shown on numerous occasions and throughout this Response how he properly uses the
Dirac delta function and the Committee does not show otherwise. Furthermore,
Applicant's state-of-the-art experimental evidence of record confirms the proper use of
the Dirac delta function by showing the lower energy states predicted by his modern
theory.

On pages 35-36 of the Consolidated Appendix, the Committee further incorrectly
states:

> In contrast to a point charge which may be "represented" by a Dirac
> delta function, the charge density is a smeared-out distribution. This issue
> was raised on p. 3 of the Appendix attached to the previous office action.
> Applicant's response on pp. 52-53 of the amendment does not address
> this point.

> Applicant states that his electron is an "extended particle - not a point
> source" (p. 53). This only emphasizes the correctness of the examiner's
> position. By definition, the Dirac delta function is an "infinitely high,
> infinitely thin spike" representing the "charge density for a *point* charge."
> See Arfken at p. 413. Therefore, it is mathematically improper to use a
> Dirac delta function appropriate for a point charge to represent an
> "extended particle" which, as applicant stated, is not a point source. Since
> the charge density, and thus the radial function, is a solution to applicant's
> classical wave equation for an "extended particle," the use of a Dirac delta
> function appropriate for a point charge vitiates applicant's theory.

Throughout this and prior responses, Applicant has shown mathematically how
the Dirac delta function is properly used in his modern theory based on classical laws.
The Committee's mere argument that, because the Dirac delta function was improperly
used for the phantom point charge in quantum theory, it somehow can have no other
use is irrelevant. The Committee has not shown any flaws in Applicant's use of the
Dirac delta function, or in any other part of Applicant's modern theory. Furthermore,
Applicant's state-of-the-art experimental evidence of record confirms the proper use of

the Dirac delta function by showing the lower energy states predicted by his modern theory.

On page 37 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant has submitted a *paper co-authored by the applicant* Mills and Kneizys **(see** Mills, R. C. and Kneizys, s. p. (1991) *Fusion Technology,* vol. 20, pp. 65-81) entitled "Excess heat production by the electrolysis of an aqueous potassium carbonate electrolyte and the implications for cold fusion" which is included as attachment 27 in the amendment. In this paper, equations (1) to (3) are *identical in all respects* to the equations that form the basis for predicting the fractional quantum energy states of an electron in the "hydrino atom." Observing that the phrases "shrunken atoms" (abstract of the paper) or "shrunken hydrogen atoms" (p. 81 of the paper) are synonymous with the "hydrino atom," particular note should be made of the following quotation in the abstract of the paper:
>
> > "According to a *novel atomic mode4* the predominant source of heat of the phenomenon called *cold fusion is the electrocatalytically induced reaction whereby hydrogen atoms undergo transitions to quantized energy levels of lower energy than the conventional ground state. These lower energy states correspond to fractional quantum numbers."* Emphases added.

Since it is not understood as to how applicant can logically *disavow* cold fusion predicted by his theory (see, e.g., the "Foreword" on p. xi of his book in attachment 16) and *at the same time endorse* a "hydrino atom" predicted from the *very same theory,* it is apparent that troubling questions remain regarding the validity of the applicant's theory.

With no real evidence on its side with which to refute Applicant's compelling scientific evidence, the Committee, led by BMS President Souw, is left with resurrecting old arguments previously abandoned by the PTO that attempt to brand Applicant's invention with the "cold fusion" label. Contrary to the Committee's statements, Applicant's theory does NOT predict cold fusion.

Cold fusion according to Pons and Fleishmann and followers is NOT disclosed and is rejected by Applicant's theory. No fusion by compression of hydrogen isotopes in metal lattices is disclosed, supported, or claimed, and the Committee knows this full well. The present application does not claim the above disclosed mechanism; thus, it is irrelevant to the present prosecution.

In the early 1990's, the PTO argued that applicant's invention was related to cold fusion. When Applicant proved it wrong, the PTO dropped the argument. In 1998, the PTO resurrected the cold fusion argument as an excuse to withdraw five of Applicant's allowed applications from issuance. However, faced with no evidence to support its position at trial, the PTO again dropped the "cold fusion" argument. Astonishingly, now eight years later, the Committee again raises the very same cold fusion arguments, with no evidence to support its position. Instead of advancing the prosecution in this case, the Committee is stuck in a time warp by cyclically resurrecting dead issues to further its "allowance is not an option" policy.

As the PTO did so many years ago, the Committee now again distorts the disclosure of Applicant's paper [R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991)]. Two decades ago, Applicant presented experimental data that heat was observed with the combination of a predicted catalyst and atomic hydrogen produced by electrolysis. **This data stands independently of fusion and is not claimed as fusion**. Considering the scientific integrity and capability of other independent scientists reporting that heat was involved in certain electrolysis reactions, **the authors present a case that novel chemical reactions should be considered rather than fusion as the source of the heat**. The paper reported that heat was released that was due to a chemical reaction—not a nuclear reaction. It reported that researchers studying the phenomenon of heat release in electrolytic cells should consider this as the source of heat—not fusion. From R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991):

DISCUSSION

The data clearly indicate that excess heat was generated. Once the technique was perfected, each experiment using potassium carbonate produced excess heat. Some experiments were permitted to operate for weeks, and the excess heat remained relatively constant. What is the source of this excess enthalpy? Electrochemical reactions which consume the electrolyte can be ruled out because any proposed electrochemical reactant would be completely consumed over the duration of these experiments. Nickel forms a hydride during cathodic electrolysis, but this process is endothermic [11]. The weight of the nickel cathode was unchanged by use in a heat producing cell to within one hundred thousandth of a gram (the cathode was rinsed after 36 hours of operation, and dried and degassed in vacuum before the final weight was

determined). The only remaining candidates are heat releasing reactions involving the electrolytically generated hydrogen or oxygen atoms or molecules. Because the excess enthalpy exceeds that which can be accounted for due to complete recombination, new processes must be sought.

The results are consistent with the release of heat energy from hydrogen atoms where the K^+/K^+ electrocatalytic couple induces the electrons of hydrogen atoms to relax to a quantized potential energy level below that of the "ground" state by providing a redox energy-energy hole (27.28 eV) resonant with this transition. The balanced reaction is given by Equations 4.13-4.14 and Equation 4.8. Excess heat was also measured when K_2CO_3 was replaced by Rb_2CO_3 (manuscript in preparation). The Rb^+ ion (Energy hole from the second ionization is 27.28 eV) alone is electrocatalytic according to the reaction given by Equations 4.9-4.10 and Equation 4.8. No excess heat was observed when K_2CO_3 was replaced by Na_2CO_3 as demonstrated with Na_2CO_3 #18-Na_2CO_3 #18A and Na_2CO_3 #19-Na_2CO_3 #19A shown in Figures 8 and 9, respectively. For sodium or sodium ions no electrocatalytic reaction of approximately 27.21 eV is possible. For example, 42.15 eV of energy is absorbed by the reverse of the reaction given in Equation 4.14 where Na^+ replaces K^+ :

$$Na^+ + Na^+ + 42.15\,eV \,\cancel{E}\, Na + Na^{2+}$$

The independent replication of these heat results were published [V. Noninski, Fusion Technol., Vol. 21, 163 (1992)]. Dr. Noninski of the Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER) successfully reproduced the results of Mills and Kneizys [R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991)] as a visiting professor at Franklin and Marshall College. A significant increase in temperature with every watt input, compared with the calibration experiment ($\approx 50\ °C\ /\ W$ versus $\approx 30\ °C\ /\ W$), was observed during the electrolysis of potassium carbonate. This effect was not observed when sodium carbonate was electrolyzed. No trivial explanation (in terms of chemical reactions, change in heat transfer properties, etc.) of this effect were found.

Applicant did hypothesize two decades ago that hydrino catalyzed fusion may be possible, **which is based on the experimentally proven and well accepted muon-catalyzed fusion, NOT COLD FUSION.**

The Committee's obvious confusion on this issue undercuts the rejections in this case, which therefore should be withdrawn.

Applicant further objects to the Committee's suggestion that Applicant's

hypothesis somehow denigrates the experimental results of record. Applicant's experimental evidence demonstrating the existence of lower-energy hydrogen confirms Applicant's theory accurately predicted the lower energy states of hydrogen. That experimental evidence stands on its own and has absolutely <u>nothing</u> to do with cold fusion.

Additionally, in bringing up the subject of cold fusion, the Committee has raised a new standard that unwittingly invalidates quantum theory and further damages the underlying basis for its rejections. As the Committee argues, if a theory makes predictions that do not or cannot exist, i.e., "irreproducible phenomena," then "the scientific basis of [that] theory/experimental results and the reproducibility of the experimental results at first glance are questionable." Thus, for example, outdated quantum theory for many decades predicted that the expansion of the universe was decelerating. However, modern data clearly showed that to be wrong—the universe is expanding at an accelerating rate. For this reason alone, under the Committee's own standard, all of the experimental evidence relating to quantum theory is suspect and, thus, that outdated theory cannot be used as a legitimate basis for questioning and criticizing Applicant's credible evidence. Applicant notes that his modern theory accurately predicted that the expansion of the universe was accelerating long before recent experimental evidence proved such to be the case, lending further support to the superiority of Applicant's more advanced theory and evidence.

Furthermore, outdated quantum theory is also fatally flawed since the physics of an all-space-point-particle-probability wave is nonsensical. It violates all fundamental principles including conservation of energy, momentum, causality, and is not stable to radiation. Applicant has listed numerous other examples where quantum theory has made incorrect predictions, and for the reasons stated by the Committee under its own standard, that flawed, outdated theory is questionable and certainly cannot be used as a valid excuse to ignore Applicant's compelling experimental evidence. Applicant therefore again requests that the Committee fairly consider that evidence without further delay.

On pages 37-38 of the Consolidated Appendix, the Committee further incorrectly states:

Given the direct connection between cold fusion and the "hydrino atom" in light of the fact that both are *tightly linked via* the applicant's theory of "hydrino atom" having fractional quantum number energy states, should applicant argue otherwise, it of interest to note that in *In re Swartz,* **56 USPQ2d 1703, 1704** (Fed. Cir. 2000) the court found Swartz's argument that his claims were directed to a process other than cold fusion to be unpersuasive. Swartz's claims to an invention in the area of cold fusion were affirmed to be nonenabling and lacking in utility.

As previously discussed herein, Applicant's modern theory does NOT predict or relate to cold fusion on any level. The Committee's contrived cold fusion argument is disingenuous and does not amount to evidence. While *In re Swartz* relates to a situation where the invention may have been "incredible" since it is based on cold fusion, that case is diametrically opposed to the one here, where Applicant's technology complies with all known physical laws and is experimentally verified.

On page 39 of the Consolidated Appendix, the Committee further incorrectly states:

It is of interest that on p. 65 in applicant Mills and Kneizys's paper (attachment 27 cited in the preceding section), the *Schrodinger equation* was criticized on the grounds that it *"does not explain the phenomenon referred to as 'cold' nuclear fusion."* In light of that, it would appear to be logical to conclude that the correctness of the Schrodinger equation is thereby confirmed precisely because it does *not* predict an irreproducible phenomenon, such as cold fusion, from which applicant has distanced himself, whereas, in stark contrast, it is the applicant who established (over 16 pages in his paper) that his theory of the "hydrino atom" *does* make such a prediction. The latter forms no solid foundation upon which a proper scientific theory should rest.

This argument is incoherent. As shown conclusively above, Applicant's theory does NOT predict cold fusion. Whether or not the Schrodinger equation predicts cold fusion has no bearing on whether it is correct or not. Furthermore, the Committee's comments are rebutted by its own admission that the Schrodinger equation is flawed since it does not account for spin and relativity.

On pages 40-41 of the Consolidated Appendix, the Committee further incorrectly states:

On pp. 15 and 42 of the amendment, applicant cites Fuchs and Peres in a paper entitled "Quantum theory needs no 'interpretation'," as saying "Quantum theory does *not* describe physical reality." [Footnote omitted.]

Applicant's implication is that quantum mechanics and, in particular, the Schrodinger equation are somehow undermined. To show the error in this argument, the examiner sets forth below his own analysis of Fuchs and Peres's paper. What the applicant omitted to include is that in the sentence immediately preceding the above-quoted portion, Fuchs and Peres state that:

> "[T]rying to fulfill a *classical worldview* by *encumbering* quantum mechanics ... without *an, improvement in its predictive power, only gives the illusion of better understanding.*" Emphasis added.

And, again, at p. 71 *op. cit.* they state:

> "However, to make quantum mechanics a useful guide to the phenomena around us, we need nothing more than *the fully consistent theory we already have.* Quantum theory needs no *'interpretation'*"

In other words, Fuchs and Peres are *not* critical at all of quantum mechanics provided it is understood as being *useful in an operational or algorithmic sense,* rather than philosophically. Instead, they are alerting the reader to the fact that a classical viewpoint is more of a *hindrance* when intermingled with quantum mechanics in that it leads one to the illusory feeling of having an improved theory when, in fact, such is not the case. Seen in its proper context, Fuchs and Peres' cautionary statement is a warning against making a *naïve philosophical comparison* between physical reality and quantum mechanics.

The Committee's warning against comparing physical reality and quantum mechanics is astonishing. Applicant prefers to deal with physical reality, i.e., classical laws and real-world experimental evidence, unlike the Committee, which prefers to delve into a fantasy world of multiple dimensions and other weird phenomenon that have no basis in reality. Applicant's modern theory, by applying classical laws to the electron and dealing directly with physical reality, achieves spectacular results, including the discovery of lower energy states.

The Committee has failed to rebut Applicant's showing that the "weird" quantum theory upon which it so steadfastly relies does not represent "physical reality" and violates classical laws. Applicant requests that the Committee look past outdated quantum theory and begin to consider the experimental evidence of record, which does

represent physical reality.

On page 41 of the Consolidated Appendix, the Committee further incorrectly states:

> It is noted that the probabilistic aspects of quantum mechanics created considerable interest among the leading scientists of the day. In order to provide a proper counterbalance to applicant's allegations regarding the foundations of quantum mechanics, attention is directed to pp. 64-85 of Fine (1986) which provides an appraisal of some of these characteristics of quantum mechanics based on a deep and insightful analysis of correspondence between Einstein and Schrodinger on these issues. It is observed that the pragmatic success of quantum mechanics is never in doubt despite ongoing philosophical exchanges.

It is nonsensical to apply statistics to a single atomic particle. As discussed previously, these issues are discussed in Chp 15 of Mills GUT and the paper

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, in press as shown in the following excerpt:

It was reported previously [9] that the behavior of free electrons in superfluid helium has again forced the issue of the meaning of the wavefunction. Electrons form bubbles in superfluid helium which reveal that the electron is real and that a physical interpretation of the wavefunction is necessary. Furthermore, when irradiated with light of energy of about a 0.5 to several electron volts [9, 14], the electrons carry current at different rates as if they exist with different sizes. The nature of the wavefunction needs to be addressed. It is time for the physical rather than the mathematical nature of the wavefunction to be determined. A classical derivation based on an extended electron was shown previously to be in complete agreement with observations; whereas, quantum mechanics has no utility [7, 9].

From the time of its inception, quantum mechanics (QM) has been controversial because its foundations are in conflict with physical laws and are internally inconsistent. Interpretations of quantum mechanics such as hidden variables, multiple worlds, consistency rules, and spontaneous collapse have been put forward in an attempt to base the theory in reality. Unfortunately many theoreticians ignore the requirement that the wave function must be real and physical in order for it to be considered a valid description of reality. For

example, regarding this issue Fuchs and Peres believe [15] "Contrary to those desires, quantum theory does *not* describe physical reality. What it does is provide an algorithm for computing *probabilities* for macroscopic events ("detector ticks") that are the consequences of our experimental interventions. This strict definition of the scope of quantum theory is the only interpretation ever needed, whether by experimenters or theorists".

With Penning traps, it is possible to measure transitions including those with hyperfine levels of electrons of single ions. This case can be experimentally distinguished from statistics over equivalent transitions in many ions. Whether many or one, the transition energies are always identical within the resonant line width. So, *probabilities* have no place in describing atomic energy levels. Moreover, quantum theory is incompatible with probability theory since it is based on underlying unknown, but determined outcomes as discussed previously [9].

Wavefunction solutions of the Schrödinger equation are interpreted as probability-density functions. Quantum theory confuses the concepts of a wave and a probability-density function that are based on totally different mathematical and physical principles. The use of "probability" in this instance does not conform to the mathematical rules and principles of probability theory. Statistical theory is based on an existing deterministic reality with incomplete information; whereas, quantum measurement acts on a "probability-density function" to determine a reality that did not exist before the measurement. Additionally, it is nonsensical to treat a single particle such as an electron as if it was a population of electrons and to assign the single electron to a statistical distribution over many states. The electron has conjugate degrees of freedom such as position, momentum, and energy that obey conservation laws in an inverse-r Coulomb field. A single electron cannot have multiple positions and momenta or energies simultaneously.

The Copenhagen interpretation provides another meaning of quantum mechanics. It asserts that what we observe is all we can know; any speculation about what an electron, photon, atom, or other atomic-sized entity is really or what it is doing when we are not looking is just that—speculation. The postulate of quantum measurement asserts that the process of measuring an observable forces it into a state of reality. In other words, reality is irrelevant until a measurement is made. In the case of electrons in superfluid helium, the fallacy with this position is that the "ticks" (migration times of electron bubbles) reveal that the electron is

real before a measurement is made. Furthermore, experiments on transitions on single ions such as Ba^+ in a Penning trap under continuous observation demonstrate that the postulate of quantum measurement of quantum mechanics is experimentally disproved as discussed previously [9, 16]. These issues and other such flawed philosophies and interpretations of experiments that arise from quantum mechanics were discussed previously [1-10].

QM gives correlations with experimental data. It does not explain the mechanism for the observed data. But, it should not be surprising that it may give good correlations given that the constraints of internal consistency and conformance to physical laws are removed for a wave equation with an infinite number of solutions wherein the solutions may be formulated as an infinite series of eigenfunctions with variable parameters. There are no physical constraints on the parameters. They may even correspond to unobservables such as virtual particles, hyperdimensions, effective nuclear charge, polarization of the vacuum, worm holes, spooky action at a distance, infinities, parallel universes, faster than light travel, etc. If you invoke the constraints of internal consistency and conformance to physical laws, quantum mechanics has never successfully solved a physical problem as discussed previously [6].

Reanalysis of old experiments and many new experiments including electrons in superfluid helium challenge the Schrödinger equation predictions. Many noted physicists rejected quantum mechanics. Feynman also attempted to use first principles including Maxwell's equations to discover new physics to replace quantum mechanics [17]. Other great physicists of the 20th century searched. "Einstein [...] insisted [...] that a more detailed, wholly deterministic theory must underlie the vagaries of quantum mechanics" [18]. He felt that scientists were misinterpreting the data. These issues and the results of many experiments such as the wave-particle duality, the Lamb shift, anomalous magnetic moment of the electron, transition and decay lifetimes, experiments invoking interpretations of spooky action at a distance such as the Aspect experiment, entanglement, and double-slit-type experiments are shown to be absolutely predictable and physical in the context of a theory of classical quantum mechanics (CQM) derived from first principles [2-10].

On page 42-45 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant argues on p. 28 of the amendment that the Heisenberg
> Uncertainty Principle, a cornerstone of quantum mechanics, has been

"demonstrated experimentally to fail" citing Durr et al. (see attachment 58, Durr, S., Nonn, T. and Rempe, G. (1998) *Nature,* vol. 395, pp. 33-37). The examiner disagrees.

By way of introduction, it is noted that according to one way of stating the Heisenberg Uncertainty Principle:

> "[I]t is *impossible* to specify precisely <u>and</u> simultaneously the values of both members of particular pairs of physical variables (known as 'canonically conjugate variables') that describe the behavior of an atomic system." Emphasis added.

See p. 7 of Schiff (1968). For canonically conjugate variables such as the position (x) and the momentum in that direction (pj, the mathematical equivalent of the above statement is

$$\textit{Jx. Zlp}\sim \_ h,$$

where Zlx and Llp~ represent the uncertainties in the values of x and $p_{,0}$ respectively. See Schiff at p. 8, equation (3.1). A mathematical formulation of the Uncertainty Principle, as applied to a wave packet, is given on pp. 60-6 1 of Schiff.

An alternative mathematical statement of the Uncertainty Principle is:

> "The *extension* of a wave _(x) and that of its Fourier transform 'p(~), where *ço(p) = (2schj^{1} J~,'°thc _(x) er~"~,* cannot *simultaneously* be made *arbitrarily small."*

See p. 130 of Messiah (1958).

It is important to observe that Heisenberg's Uncertainty Principle is no mere philosophical doctrine subject to arbitrary unscientific interpretations. Rather it is established from a proper mathematical basis as is evident from the original formulation in a paper published by Heisenberg (1927). Due to the fact that the applicant appears to have drawn erroneous conclusions based on a misunderstanding of the Uncertainty Principle, in order to provide an objective counterbalance, the examiner deems it appropriate to include copies of both the original paper in German (I-Heisenberg (1927)) *and* a translation of it (Wheeler and Zurek (1983)) with this response.

The *true* significance of the Uncertainty Principle is most clearly brought out by the following quotations from Tolman (1979) and Merzbacher (1961):

> "The most striking consequence of Heisenberg's Uncertainty Principle is the *indeterminacy* which it introduces into the possibilities of physical prediction. In the classical mechanics we grew accustomed to the idea that an exact knowledge of the coordinates and momenta of a system at a given initial time would then make it possible, with the help of the equations of motion, to make an *exact* prediction as to the future behavior of the system. We now see, however, that *such exact knowledge* of the initial values of both the coordinates and momenta *is not possible, and hence must give up our older ideas* of the possibility of exact prediction and of a complete causal dependence of the later on the earlier behavior of a mechanical system.

Such a conclusion produces a *drastic change in the ideology of thence* Tolman *op. cit.* at p. 187.

And:

> "The probability doctrine of quantum mechanics asserts that the *indetermination,* of which we have just given an example [i.e. the double-slit experiment that is described in greater detail below] is *a property* <u>*inherent*</u> <u>*in nature*</u> *and not merely a profession of our temporary ignorance from which we expect to be relieved by a future better and more complete theory."* (Emphasis added). Merzbacher *op. cit.* at p. 12.

Turning attention to Durr et al.'s article in *Nature"*, entitled "Origin of quantum-mechanical complementarity probed by a 'which-way' experiment in an atom interferometer," it is noted that therein is described an experiment with an atom interferometer which splits an incoming beam of atoms A into separate beams B and C, allows the split beams to propagate, and then again splits each of beams B and C into beams D, F and E, G, respectively. [Footnote omitted.] An interference pattern is produced by the overlap of beams E and F in momentum space. Using a which-way detector to monitor the beams destroys the interference pattern. The article emphasizes that no mechanical double-slit is used, no position measurement is performed, and because the atom is not localized the uncertainty principle cannot be "invoked." See p. 36 of the article. Rather than invoke the Heisenberg Uncertainty Principle, the article suggests an *alternative explanation* for this effect in terms of correlations between the which-way detector and the motion of the atoms. *In no way does this show, nor does the article say, that the Uncertainty Principle is untenable.*

It is observed that the above experiment is *not* the same as the well-known double-slit experiment where the passage of a single electron or photon through the slits creates a diffraction or interference pattern on a screen placed behind the slits opposite to a source of the electron or photon. Any attempt to detect which of the two slits the electron or photon actually passes through destroys the diffraction pattern and the traditional explanation for this is based on the Heisenberg Uncertainty Principle as shown, e.g., in Feynman et al. (1965) at pp. 1-6 to 1-9. In light of the fact that the applicant has failed to clarify as to why an experiment using an atom interferometer is relevant to explaining the effects produced in a double-slit experiment and, further, in the absence of any support in the article to explicitly negate the Heisenberg Uncertainty Principle, applicant's statements concerning that principle remain no more than untested opinions.

The Committee is confused by its insistence that correct mathematics equates to correct physics. It does not matter that the Heisenberg Uncertainty Principle (HUP) follows from the probability-wave description of the Schrodinger equation (SE). This description of the electrons in NOT based in reality.

The Committee is relying on the false presumption of the validity of the SE and the prediction that the electron has no physical form, but is every where at once with an infinite number of positions and energies simultaneously, to the justify a further distortion of reality— that the momentum and position of an electron can not be single valued even in the absence of measurement. Such a situation violates all physical laws and is not in agreement with causality or reality in general as pointed out in detail in the following paper:

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151.

The results of Durr et al. are predicted from first principles as given in Chp. 33 of Mills GUT. These results are not consistent with the wave-particle duality aspect implicit in the HUP as stated by Durr et al. and discussed in Mills Chp 33. Furthermore, in contradiction to the Examiner's position, the results of the electron- and photon-double-slit experiments are predicted classically in exact equations from the nature of the photon and the free electron as given in Chp. 8 of Mills GUT.

Once again, Applicant has clearly demonstrated that outdated quantum theory is mathematically flawed, violates physical laws, and does not account for state-of-the-art experimental evidence of record. In contrast, Applicant's modern theory is based on classical laws and is fully supported by the experimental evidence of record.

On pages 46-48 of the Consolidated Appendix, the Committee further incorrectly states:

> On pp. 31-32 of the amendment, applicant contends that the Feynman "derivation" of the size of the hydrogen atom is flawed and raises five issues to which a point-by-point response follows. Initially, it is noted that the purpose of Feynman's derivation was to demonstrate a *back-of the-envelope estimate* that would give some idea of the size of the hydrogen atom in its ground state in light of the Heisenberg Uncertainty Principle. To quote Feynman et al. (1965) at p. *2-5:*
>
>> "We now consider another application of the uncertainty relation ... . It [i.e. the application] must not be taken too seriously; *the idea is right* but the analysis is not very accurate. The idea has to do with the determination of the size of atoms, and the fact that, *classically, the electrons would radiate and spiral in until they settle right on top of the nucleus. But that cannot be right quantum-mechanically because then we would know where each electron was and how fast it was moving* [i.e. in violation of the Heisenberg Uncertainty Principle]."
>
> It is noted that *a fully accurate* derivation of the Bohr radius *is* given in Pauling and Wilson (1985) at pp. 121-124 and 140 as described in the Appendix attached to the previous office action. This *accurate derivation fully confirms the value of the Bohr radius that Feynman obtained* by his method. Applicant's arguments must be read in this context.
>
> With respect, then, to applicant's point "1" (see pp. 31-32 of the amendment), contrary to applicant's position, it is noted that it is routine to use "order of magnitude" estimates when doing a "back-of-the-envelope" calculation. Not only Feynman but also others of skill, such as Schiff (1968) at pp. 10-12, routinely use it with the full understanding that it does not supplant an accurate derivation. It is analogous to doing a pilot project before embarking on a more detailed costly venture. In scientific research, it enables one of skill to assess the relative significance of different variables or parameters and points to those that must be considered in the more detailed program. Likewise, in the art it is observed that it is routine to do a rough estimate before embarking on a more accurate derivation. The justification is whether the final result tallies with the result of a fully

accurate derivation - which it *does in this case* as mentioned above. The confidence placed on such an estimate depends on the skill level of the practitioner in the art. With regard to the latter, Feynman's credentials as stated on p. 9 (see, esp., the footnote) of this response stand as an adequate testament. It is quite safely stated that one of such skill would have known the difference between uncertainty in a variable and the variable itself prior to doing an estimate.

With respect to point "2", contrary to applicant's position, there is no inconsistency in using the *formula (1/2) rtxv²* for the kinetic energy in quantum mechanics. To see this, recall that in quantum mechanics (see, e.g., Merzbacher (1961) at p. 4) the kinetic energy (I) and linear momentum (p) operators are defined as $-(h^2/2m)A^2$ and $(h/z)A$, respectively. See p. 3 for the meaning of the symbols. The bolded symbols denote vector quantities. It follows that:

$$T\,E\,-(h^2/2m)A^2 = \textit{(1/2m)}\,(h/i)A\cdot(h/:)A = (p\ \textit{p})\textit{12m}.$$

That is, the kinetic energy variable corresponding to the operator *T* is the same as the variable corresponding to the operator (p ***p***)/2m which, since linear momentum is my, yields (mv• *mv)/2m* or *(1/2)mv.*

With respect to point "3", contrary to applicant's position, no problem is seen in arriving at an exact answer by doing a back-of-the-envelope type of calculation. One should not expect it, but it hardly negates the estimate. If anything, it may strengthen confidence in the estimation procedure. The ultimate justification lies in the fact that the estimate is verified by an accurate derivation, which, as stated previously, *is the case here.* -

With respect to point "4", it is not understood as to what the point of disagreement is given that applicant himself admits that the result of his own derivation agrees with Feynman's result.

With respect to point "5", this is based on applicant's opinion that the Heisenberg Uncertainty Principle is "not based on physics. In fact, it is nonsensical ... ." See p. 31 of the amendment. Since no experimental evidence has overthrown that principle and applicant's interpretation of Durr et al.'s article in *Nature* (attachment 58) regarding the principle was shown above to be in error (see §14), applicant's opinion remains untested and, in the absence of objective evidence, cannot be given patentable weight.

Applicant's published peer reviewed paper, "The Fallacy of Feynman's Argument on

the Stability of the Hydrogen Atom According to Quantum Mechanics", Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151, demonstrates that outdated quantum theory provides no basis for the stability of the hydrogen, and does not provide any physical basis for why the hydrogen atom can not transition to lower energy states and release energy. This undercuts arguments by the Committee and the APS (American Physical Society) critics that, according to outdated quantum theory, it is impossible to go below the ground state to form hydrinos. Statements such as "the hydrogen atom is run down like a clock" and "it is impossible to go South of the South Pole" are revealed to be baseless.

The Committee's reliance on the Feynman argument to "prove" the stability of the hydrogen atom is misplaced, as it is physically and mathematically incorrect as pointed out in the paper:

80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151.

This has been shown not only by Applicant, but by other theoreticians as well. Furthermore, as shown in this paper, in addition to the data of Durr et al., the HUP is experimentally disproved by failure to observe a noncausal world and the failure to observe an infinite cosmological constant. Interferometry measurements on stellar objects also disproves the HUP.

Thus, the Committee's reliance upon weird quantum theory to avoid considering Applicant's real-world scientific evidence cannot stand. Applicant requests that the Committee stop this nonsensical reliance on an outdated theory it admits "needs improvement" and is only "fundamentally correct" and that it begin to fairly consider the experimental evidence of record.

On page 49 of the Consolidated Appendix, the Committee further incorrectly states:

> The applicant has, in more than one instance, failed to correctly describe the prior art of record. A case in point is applicant's mischaracterization of the experimental results of the plasma group published in the Journal of Applied Physics in 2005 (Cvetanovic et al., J. Appl. Phys. (2005)) which criticized applicant's RTM explanation of his

plasma data published in the Journal of Applied Physics in 2002 (Mills et al., J. Appl. Phys. 92, 7008 (2002)). Applicant states on page **169-170** in his response filed on 5/23/2005 in U.S. Serial No. 09/669,877 that he "agrees with the data reported in the Cvetanovic paper that the line energy of the hot H is independent of the direction relative to the electric field, it is symmetrical at all angles and independent of pressure and exists in region of low or no field" and that the results "confirm the catalysis, not field acceleration as the source of the broadened H lines." The paper by Cvetanovic et al. never mentions the term "field acceleration" and the paper clearly did not agree with applicant's proposed catalysis mechanism as the source of line broadening in the plasma experiments.

Applicant takes strong exception with the Committee's allegation that Applicant has made misrepresentations. As discussed fully above, Cvetanovic is not credible and is nothing more than a thinly veiled hatchet job. Furthermore, in light of the Committee's reliance upon a clear fraud perpetrated by Dr. Rathke in combination with its reliance upon Cvetanovic, the Committee should be careful of accusing Applicant of making misrepresentations.

Furthermore, as discussed below, Cvetanovic reaches conclusions regarding Applicant's catalysis mechanism that are clearly wrong and, thus, is himself guilty of making misrepresentations, not Applicant.

On pages 49-50 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant's attempts to discredit the Cvetanovic paper by asserting the following (see page 168 in response filed on 5/23/2005 in U.S. Serial No. 09/669,877):
>
> ". . . the text of the article contains some clear misrepresentations. Specifically, the data regarding the fit of Figure 4c (but notably not that of Figures 4a and 4b) is missing. It also appears to the careful reader that Fig. 4c was printed in a larger format than Figures 4a and 4b, and hence gives the appearance to the. casual reader that the broadening in Figure 4c is larger than that of figures 4a and 4b. In fact, the broadening in Figure 4c is virtually identical to that measured for Figures 4a and 4b."
>
> Applicant's statements above have no merit and also contain some inconsistencies. It is unclear how applicant would know that the broadening in Figure 4c is virtually identical to that calculated for Figures 4a and 4b if the paper as alleged by applicant did not provide the data regarding the fit of Figure 4c. As one of ordinary skill would know, the line

broadening cannot be visualized or observed as implied by applicant
about the larger size format of Figure 4(c). The line broadening in a
spectral line must be mathematically determined by using a Voigt profile
which is a convolution of many contributions to the line widths. A fit of the
spectral line to the Voigt profile enables one of ordinary skill in the art to
determine the source of line broadening. Figure 4(c) clearly indicates that
Cvetanovic et al. has done the appropriate analysis of his data. It is
applicant who mischaracterizes the results of the Cvetanovic et al. paper
in response to the paper's refutation of applicant's RTM model as a source
of H a line broadening in applicant's plasma data reported in applicant's
2002 Journal of Applied Physics paper.

With regard to Figs. 4a-4c, Applicant has scanned in the data and curve-fit it with
a Gaussian fit. The broadening was found to be essentially identical to that shown in
Figures 4a and 4b. The Committee can easily confirm this by likewise scanning the
figures and curve fitting them. Like many of the Committee's other misplaced
arguments, this one too should be withdrawn, although Applicant does not realistically
expect a retraction.

The independent replication of these results with reference to the erroneous
interpretations of the data by Cvetanovic et al. is given in the paper:

105. J. Phillips, C-K Chen, K. Akhtar, B. Dhandapani, R. Mills, "Evidence
of Catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon
Plasmas", Journal of Applied Physics, submitted.

The Committee is also wrong in its suggestion to use a Voigt profile since the
broadening is clearly Doppler broadening that is fit very well by a Gaussian fit as stated
by Cvetanovic et al.

On pages 50-52 of the Consolidated Appendix, the Committee further incorrectly
states:

As another case in point of applicant's failure to correctly describe the
prior art, attention is drawn to p. 64 of a document authored by applicant
and submitted as attachment 9 along with his amendment. Therein, the
applicant states that "the many solutions of the hydrogen molecule based
on quantum mechanics have many flaws." As an instance of such alleged
flaws, applicant points to two papers by Kolos and Wolniewicz (1964)
entitled "Accurate adiabatic treatment of the ground state of the hydrogen
molecule" (hereafter, Paper I) and Kolos and Wolniewicz (1968) entitled
"Improved theoretical ground-state energy of the hydrogen molecule"

(hereafter, Paper Ii), in which "[they] use a [wave function having] 100 terms and an effective nuclear charge of 1.072."

Firstly, it is noted that the references deal with the energy levels of the two electrons in a hydrogen *molecule* (JH_2). This problem is very different from calculating the energy levels of a single electron in the hydrogen *atom* (H) due to a *crucial* interelectronic interaction that *must* be taken into account in H_2. Such an interaction is *absent* in **H**. This shows that the applicant has *failed* to compare his work with the *closest)prior art*. It is apparent that applicant has clouded his alleged evidentiary showing with *irrelevant* data.

Secondly, it is observed that applicant's designation of "a" as an "effective nuclear charge" is *not* found in the cited reference papers. Instead, the references disclose an "exponent," a, in the wave function. Rightly or wrongly, applicant has introduced his *own interpretation* of the prior art instead of letting it speak for itself.

Thirdly, a scrutiny of the above cited papers shows that applicant probably refers to Paper II. In that paper, Kolos and Wolniewicz use a 100-term wave function and refer to Paper I for details regarding the exponent. In Paper I, an 80-term wave function where the exponent a is 1.072 is disclosed. See Table II at p. 3668 therein. The applicant, however, fails to explain how the cited data supports his allegation of an alleged flaw in quantum mechanics.

On the other hand, the examiner notes that, with a 100-term wave function having the above-stated characteristics, Kolos and Wolntewicz calculated a binding energy, D_0 (referred to by applicant as a "bond energy"), of 36117.4 cm^1 which they state is "**3.8** cm~' larger than the experimental value." See p. 409 in Paper II. This means that the error in the calculated bond energy is about *one part in ten thousand or 0.01%* compared to the experimental value. The same conclusion regarding the accuracy of the theoretical value is drawn from the results for the binding energy using an 80-term wave function as disclosed in Paper I. Thus the calculated binding energy from that wave function is 38297.1 cm~^{1} compared to the experimental value of 38292.9±0.5 cm^t. See Table VIII on p.3673 in Paper I. This is a remarkable level of accuracy considering the formidable integrals for *interelectronic interactions,* i.e. integrals over $I / r_1 - r_2$, that had to be numerically evaluated in the course of the calculation as well the use of such approximations as the adiabatic approximation, due to Born, in which nuclear and electronic motion are separated in order to facilitate calculations. This represents no flaw in quantum mechanics, as alleged by the applicant. [Footnote omitted.]

Applicant also states on p. 64 of the same attachment that "[w]hereas,

Kolos and Roothaan use an effective nuclear charge of 1.197, and their predicted bond energy is 30% less than the experimental value." The examiner has consulted that reference, Kolos and Roothaan (1960) entitled "Accurate electronic wave functions for the H_2 molecule." It appears that there is *no* indication anywhere in the reference regarding applicant's cited value of the "effective nuclear charge" of 1.197 or his allegation about the 30% discrepancy in the "bond energy" value between theory and experiment. In fact, Kolos and Roothaan computed a binding energy of 4.7466 and 4.7467 eV (i.e. electron volts) compared to the experimental value of 4.7466 ± **0.0007** eV. See p. 225, right-hand column in the reference. The match between theory and experiment for the binding (applicant's "bond") energy is *nearly perfect* thus rendering applicant's statement of a 30% discrepancy in that energy value to be an unsupported allegation.

It is concluded that, contrary to applicant's imputation, quantum mechanics *cannot* be flawed if, especially, in the very examples cited by applicant himself, there is an accurate match between quantum theory and experiment. *It is apparent that applicant has confused the advances that are made in a sound scientific theory, such as quantum mechanics, as being indicative of so-called flaws. Moreover, under careful scrutiny, these "flaws" appear to be* <u>*unsupported*</u> *allegations.*

It is preposterous that the Committee would argue that the Schrodinger equation need only be required to solve the hydrogen atom, which even that it can not do correctly. If quantum is indeed the correct theory of nature as espoused by the Committee, then it should be able to at least solve the simplest molecule, H2, which is, after all, comprised of two atoms of hydrogen. However, because quantum theory cannot even solve H correctly, it most certainly cannot solve H2. Compare the poor results of that flawed, outdated theory to Applicant's more advance, modern theory that accurately solves not only H and H2, but all other atoms and a limitless number of molecules, and one can come to only one conclusion: there really is no comparison.

Applicant further notes that the effective nuclear charge of 1.072 used by Kolos and Wolniewicz is given in Table 9.1 of McQuarrie [D. A. McQuarrie, *Quantum Chemistry*, University Science Books, Mill Valley, CA, (1983), p. 353.] The effective nuclear charge of 1.197 was used by C. A. Coulson and is also given in Table 9.1 of McQuarrie.

Kolos and Wolniewicz computed a bond energy of 4.7466 and 4.74367 eV compared to the experimental value of 4.7466 ± 0.007 eV—nearly perfect. The problem is that the

experimental bond energy of H_2 is not 4.7466 ± 0.007 eV; rather, it is $E_D = 4.478\,eV$ [P. W. Atkins, *Physical Chemistry*, Second Edition, W. H. Freeman, San Francisco, (1982), p. 589]. **The result is only *nearly perfect* of a number which is NOT THE EXPERIMENTAL BOND ENERGY.** Thus, outdated quantum theory does not perfectly match the experimental results, as wrongly alleged by the Committee.

Referring to Paper I, the Committee is not even internally consistent since here too, the calculated bond energy is given as 4.748112755 (38287.1cm-1), way off compared to the experimental bond energy of H_2 of $E_D = 4.478\,eV$. This renders the rather boastful statements about the mastery of the use of approximations to remove intrinsic infinities in the calculations bogus at best.

The inconsistencies and failures of quantum theory to solve even the simplest molecule correctly prove that it is NOT a valid theory, and it cannot be relied upon to make any interpretation about which states of hydrogen can or cannot exist. Some of these failings regarding the nature of the chemical bond are pointed out in the following excerpt from the paper:

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, No. 3, (2004), pp. 342-389.

I. Introduction

Despite its successes, quantum mechanics (QM) has remained mysterious to all who have encountered it. Starting with Bohr and progressing into the present, the departure from intuitive, physical reality has widened. The connection between quantum mechanics and reality is more than just a "philosophical" issue. It reveals that quantum mechanics is not a correct or complete theory of the physical world and that inescapable internal inconsistencies and incongruities with physical observation arise when attempts are made to treat it as a physical as opposed to a purely mathematical "tool". Some of these issues are discussed previously [1-5] and in a review by Laloë [6]. The nature of the chemical bond provides a further physical problem to critically test whether quantum mechanics actually represents reality. That is, does the result given by quantum mechanics do more than reproduce an experimental number such as the bond energy of a molecule? Rather, is the result actually an accurate physical model of the molecule such as the simplest, hydrogen? A critical view with an open mind to rational new ideas is necessary for progress. Such an approach is

taken in this paper.

The Hamiltonian for the hydrogen molecule is

$$\hat{H} = -\frac{\hbar^2}{2M}\left(\nabla_A^2 + \nabla_B^2\right) - \frac{\hbar^2}{2m}\left(\nabla_1^2 + \nabla_2^2\right) - \frac{Ze^2}{4\pi\varepsilon_0 r_{1A}} - \frac{Ze^2}{4\pi\varepsilon_0 r_{1B}}$$
$$- \frac{Ze^2}{4\pi\varepsilon_0 r_{2A}} - \frac{Ze^2}{4\pi\varepsilon_0 r_{2B}} + \frac{e^2}{4\pi\varepsilon_0 r_{12}} + \frac{Ze^2}{4\pi\varepsilon_0 r_{AB}}$$

(1)

where M is the mass of the hydrogen nucleus, m is the electronic mass, Z is the atomic number of the nucleus ($Z = 1$ for hydrogen), ∇_A^2 and ∇_B^2 are the Laplacian operators with respect to the positions of nuclei A and B, ∇_1^2 and ∇_2^2 are the Laplacian operators for the positions of electron 1 and 2, and the distances between the point charges are illustrated in Figure 1. In the standard Born-Oppenheimer approximation, the nuclear motion and therefore the terms involving ∇_A^2 and ∇_B^2, are neglected. The rationale is based on the much larger mass of the nuclei compared to the electrons, but this procedure is internally inconsistent given that the bond energy is obtained by subtracting a relatively large sort of perpetual-nuclear-motion term called *zero-order* or *zero-point vibration* [7-8]. The corresponding range of the time-dependent displacement of the nuclei corresponding to the zero-point vibration is also nonnegligible[40]. Other cases that show that the Born-Oppenheimer approximation is invalid have been discussed previously [9].

As discussed *infra.*, D_e, is a parameter that is related to the bond energy by the postulated zero-point vibrational energy. Arriving at D_e independently of the vibrational energy when the molecule supposedly cannot exist in a nonzero vibrational state is internally inconsistent since vibration and bond energies are interdependent. When an molecule vibrates the nuclei move. In the case of hydrogen in the postulated zero-point state, the amplitude of the harmonic motion is about 5% that of the internuclear distance which is significant. Thus, all of the terms of the bond-energy equation must be time dynamic. That is, the electron-electron, electron-proton, and proton-proton electric and magnetic interactions and kinetic energies must be time dependent, but are not. D_e is determined under static conditions, and vibration is treated separately and grafted on in an ad hoc manner. Spin is also grafted on in an ad hoc manner. Physics such as radiation according to Maxwell's equations must be considered, but is neglected.

It is taught that "one of the great early achievements of quantum mechanics was a

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[40] The correct approach given in Sec. IIIE involves a time harmonic, stable re-entrant orbit that is consistent with all first principles including Maxwell's equations and gives results that are unique, closed form, contain fundamental constants only, and is in agreement with the experimental data.

description of the chemical bond by Heitler and London in 1927...the existence of the chemical bond is a quantum mechanical effect" [10]. The method of Heitler and London is known as the valence-bond method. Spin is ignored in the solution of Eq. (1) in the Heitler and London and other subsequently postulated methods. The phenomenon of spin is ad hoc grafted on the so-called spatial solution of Eq. (1) wherein the spin functions are simply postulated as

$$\alpha(1)\alpha(2)$$

$$\beta(1)\beta(2)$$

$$\frac{1}{\sqrt{2}}\left[\alpha(1)\beta(2)+\alpha(2)\beta(1)\right] \tag{2}$$

$$\frac{1}{\sqrt{2}}\left[\alpha(1)\beta(2)-\alpha(2)\beta(1)\right]$$

where α and β are defined as opposites of the possibilities of $\pm\frac{1}{2}$ based presumably on the atomic hydrogen result of Dirac. But, Eq. (1) is not relativistically invariant, and Dirac's result for spin is nonphysical and has many intrinsic problems[41]. No physical spin solution is attempted, and the corresponding electron-electron spin-pairing energy is neglected. This is experimentally unjustified when the isoelectronic hydride ion is considered. Here, since the hydrogen atom is electro-neutral, the only force causing the second electron to bind to form the hydride ion is the magnetic interaction between the two electrons. The resulting binding energy is relatively high. The experimental value given by Lykke [13] is $6082.99 \pm 0.15\ cm^{-1}$ (0.75418 eV). And, since the dimensions of the former are smaller, a greater interaction energy is expected.

Continuing with the method of Heitler and London, two hydrogen atoms are considered, each with its "own" electron with the hydrogen atoms in the ground state and

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[41] Dirac originally attempted to solve the bound electron physically with stability with respect to radiation according to Maxwell's equations with the further constraints that it was relativistically invariant and gave rise to electron spin [11]. He was unsuccessful and resorted to the current mathematical-probability-wave model that has many problems as discussed in Appendix II: Quantum Electrodynamics (QED) is Purely Mathematical and Has No Basis in Reality of Ref. [5]. From Weisskopf [12], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; 1.) does not explain nonradiation of bound electrons; 2.) contains an internal inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite; 3.) it admits solutions of negative rest mass and negative kinetic energy; 4.) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; 5.) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise.

Dirac's postulated relativistic wave equation also leads to the inescapable results that it gives rise to the Klein Paradox and a cosmological constant that is at least 120 orders of magnitude larger than the best observational limit as discussed in Chp. 1, Appendix II of Ref. [5] and previously [1-4].

sufficiently far apart such that the wavefunction for the two hydrogen atoms is

$$\psi_1 = 1s_A(1)1s_B(2) \qquad (3)$$

where $1s_A$ denotes a $1s$ orbital centered on nucleus A (nucleus A serves as the origin of the spherical coordinate system in which the $1s$ orbital is expressed). Similarly, $1s_B$ denotes the same thing, but with nucleus B serving as the origin. The wavefunction

$$\psi_2 = 1s_A(2)1s_B(1) \qquad (4)$$

is taken as equally valid since the electrons are presumed to be indistinguishable. Under the Heitler and London scheme, a linear combination

$$\psi = c_1\psi_1 + c_2\psi_2 \qquad (5)$$

with variable parameters c_1 and c_2 is taken as a trial function. The postulate that the two electrons are indistinguishable justifying a linear combination wavefunction such as that given by Eq. (5) gives rise to a negative energy term from Eq. (1). It gives rise to a so-called *exchange integral* touted as strictly a quantum mechanical phenomenon that arises when the electrons are interchanged between the two nuclei. Although physically impossible, the exchange integral implies that each point electron as a "probability-wave cloud" is in two places at once—centered on nucleus A and nucleus B simultaneously. The exchange integral is the sole basis of the stability of the chemical bond in H_2 according to quantum mechanics. From a physical perspective, it is true that the equivalence of the two electrons makes the interchange given by Eqs. (3-4) inconsequential and trivial, but it does not justify Eq. (5). The linear combination provides that two physical systems of the same particles exist simultaneously—a "spooky action" phenomenon that violates Einstein causality. Mathematically this allows for the bond energy and other measured numbers to be reproduced. But, is this approach physics, and does the result represent reality—specifically the hydrogen molecule?

The solution of the valence bond method gives a calculated energy of 3.15 eV compared to the experimental bond energy of 4.478 eV [10]—a difference of 42%. Additionally, one would expect that the removal of one electron from the wavefunction of the H_2 solution gives the resulting wavefunction for H_2^+, but the approach fails [10]. The appeal of a nonphysical approach is that any number may be reproduced to greater refinement, even as more accurate data is obtained, simply by the addition of more parameters, corrections, and mathematical algorithms. For example, to give solutions that match the experimental data of the total energy bond energy, ionization energy, vibrational energy, internuclear distance, etc., many methods have been postulated that cannot represent reality. In Table 9-1, McQuarrie [10] presents 13 different methods for the calculation of the parameters of the hydrogen molecule. None are rigorous, physical, unique, and internally

consistent, and the methods are themselves internally inconsistent and often contradictory. The number of terms in the wavefunctions span two to 100 and all involve mixing of the wavefunctions as given in Eq. (3-5) with variable parameters. Exemplary algorithms include valence bond, valence bond plus ionic terms, molecular orbital theory, molecular-orbital with configuration interaction, self consistent field method, SCF-LCAO-MO, Hartree-Fock, valence-shell electron-pair-repulsion (VSEPR) method, etc. In all of these and other such approaches, there is total disregard to conservation of energy, momentum, and radiation according to Maxwell's equations. The approaches involve an inconsistent plethora of invented wavefunctions and terms—Slater orbitals, ionic terms, molecular orbital with sigma bonds, pi bonds, delta bond, banana bonds, bonding orbitals, antibonding orbitals, *(negative probability density as well as positive probability density)*, back-bonding orbitals (empty space), overlap, coulomb, and exchange integrals—all with intractable infinities. Ad hoc, inconsistent types of adjustable parameters such as effective nuclear charge, ionic character, correlation interactions, and arbitrary renormalization procedures to remove infinities are introduced to force the calculations to match observations.

The results for the bond energy of the hydrogen molecule given in Table 9-1 of McQuarrie [10] range from the molecular-orbital derived 2.7 eV given by Coulson [14] which is off by 66% to 4.7467 eV given by Kolos and Wolniewicz [15] with discrepancies typically of the order of 20% of the experimental result. The natural molecular-hydrogen coordinate system based on symmetry is elliptic coordinates. James and Coolidge [10, 16] introduced a spatially symmetrical trial function of the form

$$\psi = e^{-\alpha(\lambda_1 + \lambda_2)} \sum_{m,n,j,k,p} c_{mnjkp} \left(\lambda_1^m \lambda_2^n \mu_1^j \mu_2^k \rho^p + \lambda_1^n \lambda_2^m \mu_1^k \mu_2^j \rho^p \right) \tag{6}$$

where $\rho = \dfrac{r_{12}}{r_{AB}}$ and α and c_{mnjkp}'s are variational parameters. Using 13 terms James and Coolidge arrived at $E_{dissociation} = 4.72$ eV and the internuclear distance $R_{min} = 0.074$ nm. Textbooks such as McQuarrie claim, "the calculation of James and Coolidge represents one of the great early achievements of quantum mechanics as applied to chemistry" [10], and the result of Kolos and Wolniewicz using Eq. (6) [10] is presented as even more spectacular. However, upon critical review of the details, this celebration may be judged unwarranted.

The remarkable level of precision given by the calculations of Kolos and Wolniewicz is extraordinarily dubious considering the use of such approximations as the adiabatic approximation, due to Born, in which nuclear and electronic motion are separated in order to facilitate calculations. More importantly, the integrals for *interelectronic interactions* (i.e. integrals over $\dfrac{1}{|r_1 - r_2|}$) that had to be numerically evaluated, blow up to infinity, and any

procedure to remove the infinities is purely arbitrary and not based on first principle physics. Neither the model of Kolos and Wolniewicz or any of the 13 models given in Table 9-1 can actually be the correct, unique, physical solution representative of the hydrogen molecule.

Kolos and Wolniewicz [10, 15] used 100 "terms" and an effective nuclear charge of 1.072 to calculate the bond energy of H_2. The effective nuclear charge is an ad hoc adjustable parameter used to artificially force agreement with the experiment result. The charge of the nucleus is $+1.6021892 \, X10^{-19}$ C—not 1.072 times this value. The arbitrariness of this fudge factor is demonstrated by the entries in Table 9-1. For example, Coulson [14] gives an effective nuclear charge of 1.197; whereas, Wang [17] uses 1.116. The Kolos and Wolniewicz result is further dubious in the effective nuclear charge of 1.072 times the fundamental charge is given to four significant figures; whereas, the total energy of 1.174475 hartree is given to seven significant figures—three orders of magnitude greater precision than that of the artificial charge used in the calculations.

A physical rationalization for the adjustable parameter, effective nuclear charge, is that each electron mutually shields the nuclear charge from the other. But, this argument is internally inconsistent. In quantum theory, electron shielding or self interaction of the electron cloud is ignored in cases involving one electron such as H and H_2^+, but electron-electron repulsion terms as well as shielding are considered in multielectron problems such as H_2; even though, the charge densities occupy the same space whether there is one or more electrons—the only difference being the magnitude. The electron spread over all space must interact with itself since Gauss' law applied to the volumetric charge density gives rise to a radial electric field from the positions, zero to infinity. Consequently, there is the inescapable problem that the electron cloud is unstable, not to mention the nonphysical nature of the infinities in the electric and magnetic fields of the point electron manifested as a probability cloud distribution. Specifically, each electron charge cloud with a finite radial distribution must give rise to a self-repulsive energy given by Purcell [18] as

$$\hat{H}_{self} = \frac{e^2}{8\pi\varepsilon_0 r_{2A}} + \frac{e^2}{8\pi\varepsilon_0 r_{2B}} \tag{7}$$

Since Eq. (1) does not include the self-interaction in the Hamiltonian, its solution for the energy of the hydrogen molecule is not internally consistent or correct.

Kolos and Wolniewicz, using Eq. (1) without including Eq. (7), computed a bond energy of 4.7466 and 4.74367 eV compared to the experimental value of 4.7466 ± 0.007 eV—nearly perfect. The problem is that the experimental bond energy of H_2 is not 4.7466 ± 0.007 eV; rather, it is $E_D = 4.478 \, eV$ [19]. The result is only *nearly perfect* of a number which is NOT THE EXPERIMENTAL BOND ENERGY. The explanation is that the theoretical result

of 4.74367 eV corresponds to D_e, not D_0 wherein the so-called equilibrium dissociation energy D_e is defined by difference between the minimum energy and the energy as $r_{AB} \to \infty$ on a Morse function or Morse potential. The bond dissociation energy at 0°K D_0 is given by the difference between D_e and a postulated zero-point vibrational energy E_0. In the standard quantum formulation, a molecule in the ground vibrational state has zero-point vibrational energy E_0 [8]:

$$E_0 = \frac{1}{2}hc\omega_e - \frac{1}{4}hc\omega_e x_e \tag{8}$$

And, D_e = bond dissociation energy + zero-point vibration - anharmonicity term in the zero-point vibration. Thus,

$$D_0 = D_e - E_0 = D_e - \frac{1}{2}hc\omega_e + \frac{1}{4}hc\omega_e x_e \tag{9}$$

The zero-point vibration is another nonphysical phenomenon that is unique to quantum mechanics. Quoting McQuarrie [7]: "Note also that the energy of the ground state, the state with $n = 0$, is $\frac{1}{2}h\nu$ and is not zero as the classical energy is. This is called the ZERO-POINT ENERGY of the harmonic oscillator and is a direct result of the Uncertainty Principle." Under critical scrutiny this is nonsensical. THERE IS NO ZERO-POINT VIBRATION. It is not directly experimentally observed and recent experiments disprove it.

Vibrational theory is grafted onto the electronic solution, and the algorithm involves solving a harmonic oscillator wave equation [7-8]. The result that the lowest vibrational energy state is exactly $\frac{1}{2}h\nu$ rather than exactly zero as a direct consequence of the Heisenberg Uncertainty Principle (HUP) is nonsensical given that no use of the Uncertainty Principle was used in the derivation of the Hermite polynomial wavefunction solutions [7-8]. The result of predicting zero-point vibration is incorrect. In other words, the lowest state does not come out to be zero as it should. It is after all zero in the case of rotation and translation. Remarkably, as shown in Table 9-1 of McQuarrie [10], Kolos and Wolniewicz, for example, did not even report a vibrational energy which is experimentally $E_{vib} = 0.515902\ eV$ [20-21] (over 10% of the bond energy). This makes any reported 6-7 significant figure bond energy prediction very dubious.

The bond energy is real and experimentally measurable, but the zero-point vibration and the anharmonicity in the zero-point vibration terms are fictitious, nonphysical terms that cannot be, nor have they ever been directly experimentally observed or measured. Collisions cause hot molecules to lose energy to cold surroundings. Thus, any molecular ion or molecule ultimately will undergo a transition to the zero vibration energy state as it is cooled. Thus, the thermal energy of the species will be in equilibrium with the ambient

temperature over all temperatures including the case wherein the ambient temperature approaches absolute zero. This is true, except in the case of quantum mechanics. Quantum mechanics predicts that any bond must always have vibration energy even at absolute zero. This zero-point energy [7-8] is analogous to the zero-point energy of a perfect vacuum. The latter is also a direct result of the Uncertainty Principle. In the former case, the energy of a harmonic oscillator may be written in the form $\left(\dfrac{p^2}{2\mu}\right) + \left(\dfrac{kx^2}{2}\right)$ from which it is obvious that a zero value for the energy would require that both p or x or, more precisely, the expectation values of $\hat{P}^2$ and $\hat{X}^2$ be simultaneously zero in violation of the Uncertainty Principle. This result is independent of the act of measuring the system, and it counter to classical principles and unique to quantum mechanics[42].

Zero-point vibration is associated with the wave-particle duality nature of atomic systems as a consequence of the Uncertainty Principle. The HUP is thought to an essential aspect of nature [4], but Durr et al. [22] have found a way around it, and the Uncertainty Principle was demonstrated experimentally to fail in a test of its long touted basis of the wave particle duality [2, 4]. According to Gerhard Rempe [23], who lead the Durr et al. experimental team, "*The Heisenberg uncertainty principle has nothing to do with wave-particle duality.*" Durr et al. report [22], "We show that the back action onto the atomic momentum implied by Heisenberg's position-momentum uncertainty relation cannot explain the loss of interference." The experimental results of Durr et al. of the diffraction pattern of ^{85}Rb atoms scattering from standing light waves where the internal states were manipulated by microwaves are predicted classically [24]. Other data with far-fetched interpretations based on the HUP such the existence of the same $^{9}Be^{+}$ ion in two places at once, supercurrents flowing in opposite directions at once, and spooky actions at a distance are also explained by first principle laws which demonstrate that the HUP is not a physical principle [24]. Rather it is a misinterpretation of applying the Schwartz Inequality to the wavefunction interpreted as a probability wave [4, 25].

Both zero-point energy of the vacuum and zero-point vibration are inconsistent with experimentation. In a paper by Mills [2], the former case is dismissed as implausible based on physics and experiments. In the latter case, the formation of solid hydrogen disproves it. The existence of Bose-Einstein condensates of molecules also experimentally disproves it

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[42] The confusion between a potential for the existence of a state at a precise location with zero energy and the uncertainty in the ability to measure that state as well as internal inconsistencies in the Heisenberg Uncertainty Principle and its inapplicability to the issue of stability with respect to radiation were discussed previously [2, 4-5].

[26]. Molecules are shown experimentally not to possess vibrational energy when laser cooled to near absolute zero since no corresponding Doppler shift of the cooling photons is observed [26]. Furthermore, zero-point vibration violates the second law of thermodynamics by requiring that a species with at least several hundredths of an electron volt of energy be in thermodynamic equilibrium with an ambient temperature of $100\ nK$ ($10^{-11}\ eV$) [26].

Another problem with the quantum model is that the proton may extend beyond the potential well [7-8]. And, the solutions are not a function of time; thus, time harmonic motion required to couple to the electromagnetic field is not predicted. It can be demonstrated that the resonance condition between these frequencies is to be satisfied in order to have a net change of the energy field [27]. In the quantum mechanical case, the correspondence principle does not hold. Also, zero-point vibration required by the Heisenberg Uncertainty Principle violates Maxwell's equations which require that the oscillating nuclear charges must radiate as shown by Haus [28].

Upon critical consideration of "one of the great early achievements of quantum mechanics" [10], it could be argued that any result could be reproduced with the allowance of 1.) total neglect of physical principles such as conservation of energy, momentum, and radiation according to Maxwell's equations, 2.) the liberty to set up the problem so that multiple physical systems of the same fundamental particles can exist simultaneously, 3.) neglect of, or arbitrary handling of the point-particle infinities, 4.) the existence of the point electrons everywhere at once with the absence of self interaction, 5.) the treatment of interdependent phenomena such as bond energy, spin, and the time dependence of vibration as independent, 6.) nonunique solutions obtained from an infinite number of postulated wavefunctions using nonstandard methods, 7.) an unlimited number of variational parameters (100 in the Kolos and Wolniewicz case) and adjustable parameters such as an effective nuclear charge (+1.072 in the K &W case), and 8.) the existence of phenomena such as zero-point vibration that cannot be directly experimentally measured. The procedures to arrive at the parameters of molecular hydrogen could better be categorized as a number of curve-fitting algorithms rather than physics. In fact, the state of the art can be considered a plurality of curve-fitting approaches. Popular computer programs such as. ZINDO, CIS INDO, INDO CI, AM1, AM1/D, PM3, and G3 use very large basis sets of successful wavefunctions with curve-fit parameters and adjustable parameters to interpolate to additional molecules [29-32]. Success improves reiteratively with further development of the basis sets derived from curve fitting to many cases, but typically the theoretical predictions are only qualitative [33-36]. Similarly, the successive theory of vibration-rotational spectroscopy is essentially curve fitting upon the assumption of zero-point vibration where a

series of parameters such as D_e, ω_e, and $\omega_e x_e$ are fit to the observed spectra. How is it possible to give high precision constants in standard tables [37-38] as the experimental values of something that does not exist and cannot be measured? How can a precise theory of spectroscopy [8] be built upon this unsubstantiated assumption? How can results of unmeasurable parameters such as D_e, ω_e, and $\omega_e x_e$ be represented as having any basis in reality with regard to the hydrogen molecule?

QM gives correlations with experimental data. It does not explain the mechanism for the observed data. But, it should not be surprising that it gives good correlations given that the constraints of internal consistency and conformance to physical laws are removed for a wave equation with an infinite number of solutions wherein the solutions may be formulated as an infinite series of eigenfunctions with variable parameters. There are no physical constraints on the parameters. They may even correspond to unobservables such as virtual particles, hyperdimensions, effective nuclear charge, polarization of the vacuum, spooky action at a distance, infinities, etc. If the constraints of internal consistency and conformance to physical laws are invoked, quantum mechanics has never successfully solved a physical problem.

Throughout the history of quantum theory; wherever there was an advance to a new application, it was necessary to repeat a trial-and-error experimentation to find which method of calculation gave the right answers. Often the textbooks present only the successful procedure as if it followed from first principles; and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle (e.g. phenomenological Hamiltonians) to fit the empirically successful algorithm. For example, it is known that it required a great deal of art and tact over decades of effort to get correct predictions out of Quantum Electrodynamics (QED). For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off the infinities) in one particular way and not in some other way that appears in principle equally valid. There is a corollary, noted by Kallen: from an inconsistent theory, any result may be derived. The same criticism can be applied to the nature of the chemical bond according to QM.

The QM theory of the chemical bond relies on atomic wavefunctions. The hydrogen atom is the only real problem for which the Schrödinger equation can be solved without approximations; however, it only provides three quantum numbers—not four, and inescapable disagreements between observation and predictions arise from the later postulated Dirac equation as well as the Schrödinger equation [1-6]. Furthermore, unlike

physical laws such as Maxwell's equations, it is always disconcerting to those that study quantum mechanics (QM) that the particle-wave equation and the intrinsic Heisenberg Uncertainty Principle must be accepted without any underlying physical basis for fundamental observables such as the stability of the hydrogen atom or molecule in the first place. In the former instance, a circular argument regarding definitions for parameters in the wave equation solutions and the Rydberg series of spectral lines replaces a first-principles-based prediction of those lines. It was shown previously [4-5] that the quantum theories of Bohr, Schrödinger, and Dirac provide no intrinsic stability of the hydrogen atom based on physics and that this issue brings to light the many inconsistencies and shortcomings of QM and the intrinsic HUP that have not been reconciled from the days of their inception. The issue of stability to radiation needs to be resolved, and the solution may eliminate of some of the mysteries and intrinsic problems of QM as discussed previously [1-6].

The basis of the many short comings of quantum mechanics, such as self interaction, radiation, and also infinities lies with the definition of the electron as a point-particle-probability wave that exists over all space at the same time. In order to be consistent with neutral scattering results, it has an infinite number of positions and energies SIMULTANEOUSLY! It accelerates; thus, it must radiate. It violates physical laws; thus, it is not a viable physical theory; consequently. it is not predictive.

Without being predictive, the usefulness of QM is compromised. For example, in a letter to the Editor of Chemical and Engineering News, Allan Weinstein writes [39] "as was remarked by more than one chemist in these pages over the past two or three decades, literally man-centuries of work have been wasted trying to synthesize compounds that the quantum theory unequivocally states should be stable, only to find that the compounds do not exist in any form whatsoever". He expresses the view held by many including the founders of quantum mechanics that it is not a correct or a complete theory, it is not a physical theory, it is not representative of reality—rather it has "culminated in what is simply solipsistic nihilism—"nothing can exist except what I want to exist", and a classical approach warrants consideration.

In contrast, using classical laws, Applicant's modern theory can solve molecules up to infinite length in closed-form equations containing fundamental constants only. The predictions agree to the limit of experimental results (e.g. five-figure accuracy for octadecane,

See Mills GUT Chp 11, 13, and 14). Outdated quantum theory can not match these results. Quantum theory is a complete failure at correctly solving molecules, which further demonstrates that it is not the correct theory of Nature.

On pages 53-58 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant has alleged that "the success of quantum mechanics can be attributed to *ad hoc* assumptions." See page 46 of the amendment. However, it is observed that it is the applicant who has made such assumptions on an unprecedented scale. As evidence, the examiner refers to the discussion in §s 3 through 10 in this response. In particular, reference is made to applicant's postulate of energy levels of the electron in a hydrogen atom characterized by having fractional integer principal quantum numbers without *any proper* scientific or mathematical basis as previously discussed.

> Prior to responding to applicant's allegation that the Schrödinger equation "fails to solve the hydrogen atom correctly" and that Dirac's quantum electrodynamics is "fatally flawed" (see pp. 44 and 52 of the amendment), it is noted that the Applicant has clearly *not* grasped the way *proper* scientific theories are formulated. An attempt to explain all experimental data down to the "last decimal point" in one fell swoop *via* a grand theory may result in improper mathematics and highly distorted science that cloud the credibility of such a theory. As a case in point, the examiner points to applicant's improper theory discussed at length throughout this response. On the other hand, generating a theory which, in a first pass, incorporates relatively more important effects, permits one to have a better chance in coming with up with a sound theory that is grounded in correct mathematics and is capable of scientifically progressive refinement to include all other effects until the experimental results are essentially fully accounted for. The basic scientific belief is that such progressive refinement, though seemingly slow and cautious, will nevertheless carry one along until the "final" goal is attained.

> The examiner submits that *this is exactly what happens in quantum mechanics* as evidenced by the numerous citations quoted and discussed in this response, and, as further elaborated below.

> In quantum mechanics, corrections are systematically incorporated through a progressively refined series of equations. The general idea here is to account for the "biggest chunk" of experimental data *while presenting proper mathematical and scientific basis in so doing*. In keeping with this, note the trend in which the Schrodinger equation [i.e. *ib $U_1/\partial t = ,\emptyset$ E — ($h^2/2m$) $A^2\emptyset$ + V('r) 0*] gives the following formula for the energy levels of

the electron in a hydrogen atom, setting aside corrections due to special relativity and electron spin, i.e.:

$$= - (7^2/n^2)Y,$$

where the meaning of the symbols is given in the "List of symbols" section at the beginning of this appendix. The justification for this is that these two corrections account for *only (approximately) one part in one hundred thousand or 0.001%* of the total (binding) energy of the electron in the ground state of the hydrogen atom. Indeed, that is why these corrections are collectively refined to as the *'fine* structure" corrections. See Pauling and Wilson (1985), p. 209. Next comes the Dirac equation which is:

ihôØ/Ut,ØE {c'[c(h/i)A+eA]+pm!—etp}₃b,

where ~ is a vector operator that accounts for electron spin, f3 is a **4 X 4** matrix, p and A represent the scalar and vector potentials (of an external electromagnetic field), respectively, which satisfy Maxwell's equations. See, e.g., equation (10.1) at p. 47 in Bethe and Salpeter (1977) or equation (1) at p. 104 in Heitler (1984). The solution to the above equation yields the energy levels of the electron in a hydrogen atom with the incorporation of the fine structure corrections and is expressed by the following formula (see equation (17.1) at p. 83 in Bethe and Salpeter):

$$= mc^2 [i + (acZ/\{n — k + \sim' (k^2 - a^2Z^2) \})2] (- 1/2)$$

where a is the fine structure constant and k is a quantum number whose values are 1, 2, 3, ..., n (p. **84** in Bethe and Salpeter). The meaning of the other symbols is given in the "List of symbols" section at the beginning of this appendix. It will be noted that the term aZ **is about** 1/137 for the hydrogen atom (where Z is 1), which is relatively small compared to unity. In light of this, Bethe and Salpeter have expanded the above formula for the energy, $ED;r,,,$ in powers of a^2Z^2, *not* aZ, to obtain an expression for the energy that shows the leading term in that expression to correspond to Esch followed by terms accounting for the fine structure corrections. [Footnote omitted.] Thus:

Y [i + *{(aZ)²/n}* **((1/k)** — **(3/4n)}** + **{frZ)⁴/3n}{(15/8n')** + *(3/4k³)* **+**

$$(3/2nk^2) + (3k^2/4n) — (9/2n^2k)\} + O1(aZ)'\}].$$

See equation (17.2) at p. 84 in Bethe and Salpeter. The first term above, - (Z^2/n^2) **Y, is readily seen to** be equal to the energy given by the Schrodinger equation, E&hthd~fl~~. The second term is seen to be $(aZ)^2/4$ **Of EsCh~ing~r~** The value of 1/4 for the coefficient of *(aZ)²* is obtained by

noting that $n = k = 1$ and $Z = 1$ for the ground state of the hydrogen atom. See p. 84 in Bethe and Salpeter. Substituting the value of a (from p. 3) into $(aZ)^2/4$, it is seen that the correction is 0.0000 133 of the energy given by the Schrodinger equation. The third term is seen to be $(aZ)^4/8$ of ~ Substituting the value of a, as before, into $(aZ)^4/8$, it is seen that the correction is 0.000000000355 of the energy given by the Schrodinger equation.

These corrections are thus seen to be so relatively tiny that it is well worth the price for obtaining a *mathematically and scientifically proper equation such as the Schrodinger equation.* It is *not* that one cannot incorporate the relatively minor corrections due to special relativity and electron spin into the Schrodinger equation insofar as the energy of an electron in a hydrogen atom goes. Rather, it is far better to focus on the proper science and mathematics involved in the creation of the Schrödinger equation and leave incorporation of the minor corrections in the next phase of quantum mechanics, *viz.* the Dirac equation which *does account for special relativity and electron spin.* [Footnote omitted.]

Lastly, we have quantum electrodynamics whose equations account for all that the Dirac equation does and, additionally, incorporates a "radiative correction" which also has a relatively tiny value. The purpose of this correction is to account for the experimental effect known as the **"Lamb** shift." Although, initially, quantum electrodynamics had to contend with divergences in the self-energy calculations for the electron, in modern quantum electrodynamics, such divergences are removed by the technique of "covariant renormalization" as described at p. 92 of Bethe and Salpeter and by Heitler (1984). As evidence of the remarkable accuracy of the equations of quantum electrodynamics, attention is drawn to Table 3 at p. 107 of Bethe and Salpeter, which discloses that, for the hydrogen atom, quantum electrodynamics yields a theoretical value of 1057.13 ± 0.13 Mc/s compared to the experimental value of 1057.77 ± **0.10** Mc/s for the Lamb shift. This means that the discrepancy between the theoretical value and the experimental value is *six parts in ten thousand or 0.06%* which, given the great care exercised in executing proper mathematical and scientific procedure, is more than sufficient to render applicant's arguments against quantum mechanics to be clearly less than persuasive. It is only fair that applicant's remarks regarding the alleged "failure" of the Schrodinger equation and the alleged "fatal flaw" in the Dirac equation be evaluated against the background of the above discussion.

The natural way in which integer values of the principal quantum number arise in the solutions for the Schrodinger equation has already been discussed above in § 9. With respect to the postulational nature of the Schrodinger equation, none state it better than Pauling and Wilson

(1985) at p. 52:

> *"No arbitrary postulates* concerning quantum numbers are required in this calculation [of the values of the energies of the stationary states of a system]; instead *integers enter automatically in the process of finding satisfactory solutions of the wave equation.*
>
> For our purposes, the Schrodinger equation, the auxiliary restrictions [i.e. the boundary conditions and the normalization condition] upon the wave function *0,* and the interpretation of the wave function are conveniently taken *as fundamental postulates, with noderivation from other principles necessary."*

Regarding applicant's assertion of the lack of Lorentz invariance of the Schrodinger equation, the examiner notes that Lorentz invariance is nothing other than requiring conformance with the provisions of special relativity, an issue which has been discussed and addressed in the preceding paragraphs in this section. It appears that applicant's allegations reflect a lack of understanding of the recognized fact that the Schrodinger equation *correctly* accounts for the bulk of the ground state energy of the electron, i.e. 99.999% of the energy, as explained above. The remainder is obtained *systematically* from Dirac's equation, which is fully in conformance with special relativity (i.e. it is Lorentz invariant), and from the equations of covariantly renormalized quantum electrodynamics as described previously in this section. Upon weighing the full impact of the Schrodinger equation that yields 99.999% of the ground state energy of the electron in the hydrogen atom using proper scientific and mathematical procedures (within a non-relativistic, spin-free framework) *against* applicant's improperly formulated theory of the "hydrino atom" which yields unheard-of and unverified energy states, it is quite apparent that applicant's allegations regarding "failures" and "flaws" in the Schrodinger and Dirac equations, respectively, cannot be given patentable weight.

The Committee's need to string inconsistent theories together merely proves that flawed quantum theory is not the correct physics of the atom. **The Committee admits that the Schrodinger equation misses spin**. That makes it impossible for quantum theory to predict spin. Thus, quantum theory it is mathematically flawed and incorrect.

To suggest that the Dirac equation (DE) is a more detailed version of the Schrodinger equation (SE) is not true. The DE does not reduce to the SE. It is misleading to suggest that they are a progression of refined equations. They involve totally different postulates and

have totally incompatible physical implications. The Dirac equation gives an incorrect result for the fine structure, and misses the Lamb shift and hyperfine structure. It has many problems as reported in Mills GUT (Appendix II) and in the following papers:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.
8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.
12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.
13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.
14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

The Committee further admits that the DE misses the Lamb shift. It also misses the g factor. Thus, it is impossible for outdated quantum theory to predict the g factor or the Lamb shift. Even Dirac said that quantum theory was erroneous (Mills GUT Appendix II), including

the ad hoc renormalization of intrinsic infinities. Here again, the Committee is confused

about the proper manner to mathematically solve a physical problem as discussed in

Appendix II:

> Quantum mechanics failed to predict the results of the Stern-Gerlach experiment
> which indicated the need for an additional quantum number. Quantum
> electrodynamics was proposed by Dirac in 1926 to provide a generalization of
> quantum mechanics for high energies in conformity with the theory of special
> relativity and to provide a consistent treatment of the interaction of matter with
> radiation. It relies on the unfounded notions of negative energy states of the
> vacuum, virtual particles, and gamma factors. From Weisskopf [49], "Dirac's
> quantum electrodynamics gave a more consistent derivation of the results of the
> correspondence principle, but it also brought about a number of new and serious
> difficulties." Quantum electrodynamics; 1.) does not explain nonradiation of
> bound electrons; 2.) contains an internal inconsistency with special relativity
> regarding the classical electron radius—the electron mass corresponding to its
> electric energy is infinite; 3.) it admits solutions of negative rest mass and
> negative kinetic energy; 4.) the interaction of the electron with the predicted zero-
> point field fluctuations leads to infinite kinetic energy and infinite electron mass;
> 5.) Dirac used the unacceptable states of negative mass for the description of the
> vacuum; yet, infinities still arise. In 1947, contrary to Dirac's predictions, Lamb
> discovered a $1000\ MHz$ shift between the $^{2}S_{1/2}$ state and the $^{2}P_{1/2}$ state of the
> hydrogen atom [50]. This so called Lamb Shift marked the beginning of modern
> quantum electrodynamics. In the words of Dirac [51], "No progress was made for
> 20 years. Then a development came initiated by Lamb's discovery and
> explanation of the Lamb Shift, which fundamentally changed the character of
> theoretical physics. It involved setting up rules for discarding ...infinities..."
> Renormalization is presently believed to be required of any fundamental theory of
> physics [52]. However, dissatisfaction with renormalization has been expressed
> at various times by many physicists including Dirac [53] who felt that, "This is just
> not sensible mathematics. Sensible mathematics involves neglecting a quantity
> when it turns out to be small—not neglecting it just because it is infinitely great
> and you do not want it!"

The alleged accuracy of the results of outdated quantum theory is recognized as

completely bogus when it is considered that subtle corrections to the excited-state energy

levels are attributed to vacuum polarization due to fluctuations of an infinite number of virtual

particles, and the electron has infinite energy in its electric and magnetic fields. None of this

nonsense has any experimental support, nor has it ever been demonstrated that there is a

connection to physical reality. This effect only exists in the minds of those practicing the cult

of quantum theory. The demonstration of the SE, DE, and quantum theory as failed

nonphysical theories is discussed in detail in Mills GUT and the following paper in particular:

R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

The ad hoc and nonphysical nature of quantum theory is given in the following excerpt:

II. Quantum Electrodynamics (QED)

Quantum mechanics failed to predict the results of the Stern-Gerlach experiment which indicated the need for an additional quantum number. In quantum mechanics, the spin angular momentum of the electron is called the "intrinsic angular momentum" since no physical interpretation exists. (Currents corresponding to the observed magnetic field of the electron can not exist in one dimension of four dimensional spacetime where Ampere's law and the intrinsic special relativity determine the corresponding unique current.) The Schrödinger equation is not Lorentzian invariant in violation of special relativity. The Schrödinger equation also misses the Lamb shift, the fine structure, and the hyperfine structure completely, and it is not stable to radiation. Quantum electrodynamics was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. But, it does not bridge the gap between quantum mechanics and special relativity. From Weisskopf [19], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics: (1) does not explain nonradiation of bound electrons; (2) contains an internal inconsistency with special relativity regarding the classical electron radius—the electron mass corresponding to its electric energy is infinite; (3) admits solutions of negative rest mass and negative kinetic energy; (4) leads to infinite kinetic energy and infinite electron mass for the interaction of the electron with the predicted zero-point field fluctuations (5) still yielded infinities when Dirac used the unacceptable states of negative mass for the description of the vacuum. Dirac's postulated relativistic wave equation gives the inescapable result of a cosmological constant that is at least 120 orders of magnitude larger than the best observational limit due to the unacceptable states of negative mass for the

description of the vacuum as discussed previously [2-7, 9-10][43]. The negative mass states further create an absolute "ether"-like frame in violation of special relativity which was disproved by the Michelson-Morley experiment.

In retrospect, Dirac's equation which was postulated to explain spin relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors; thus, it can not be the correct description of a bound electron even though it gives an addition quantum number interpreted as corresponding to the phenomenon of electron spin. Ironically, it is not even internally consistent with respect to its intent of being in accord with special relativity. The Dirac equation violates Maxwell's equations with respect to stability to radiation, contains an internal inconsistency with special relativity regarding the classical electron radius and states of negative rest mass and negative kinetic energy as given by Weisskopf [19], and further violates Einstein causality and locality in addition to conservation of energy as shown by the Klein Paradox discussed previously [2, 4, 7][44]. Furthermore, everyday observation demonstrates that causality and locality always hold. Einstein also argued that a probabilistic versus deterministic nature of atomic particles leads to disagreement with special relativity. In fact, the nonlocality result of the Copenhagen interpretation violates causality as shown by Einstein, Podolsky, and Rosen (EPR) in a classic paper [22] that presented a paradox involving instantaneous (faster-than-light) communication between particles called "spooky action at a distance" which led them to

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[43] The Rutherford experiment demonstrated that even atoms are comprised of essentially empty space [20]. Zero-point field fluctuations, virtual particles, and states of negative energy and mass invoked to describe the vacuum are nonsensical and have no basis in reality since they have never been observed experimentally and would correspond to an essentially infinite cosmological constant throughout the entire universe including regions of no mass. As given by Waldrop [21], "What makes this problem into something more than metaphysics is that the cosmological constant is observationally zero to a very high degree of accuracy. And yet, ordinary quantum field theory predicts that it ought to be enormous, about 120 orders of magnitude larger than the best observational limit. Moreover, this prediction is almost inescapable because it is a straightforward application of the uncertainty principle, which in this case states that every quantum field contains a certain, irreducible amount of energy even in empty space. Electrons, photons, quarks—the quantum field of every particle contributes. And that energy is exactly equivalent to the kind of pressure described by the cosmological constant. The cosmological constant has accordingly been an embarrassment and a frustration to every physicist who has ever grappled with it."

[44] Oskar Klein pointed out a glaring paradox implied by the Dirac equation which was never resolved [23]. "Electrons may penetrate an electrostatic barrier even when their kinetic energy, $E - mc^2$ is lower than the barrier. Since in Klein's example the barrier was infinitely broad this could not be associated with wave mechanical tunnel effect. It is truly a paradox: Electrons too slow to surpass the potential, may still only be partially reflected. ...Even for an infinitely high barrier, i.e. $r_2 = 1$ and energies $\approx 1\,MeV$, (the reflection coefficient) R is less than 75%! From (2) and (3) it appears that as soon as the barrier is sufficiently high: $V > 2mc^2$, electrons may transgress the repulsive wall—seemingly defying conservation of energy. ...Nor is it possible by way of the positive energy spectrum of the free electron to achieve complete Einstein causality."

conclude that quantum mechanics is not a complete or correct theory. The implications of the EPR paper and the exact Maxwellian predictions of "spooky action" and "entanglement" experiments, incorrectly interpreted in the context of quantum mechanic, are given in Chp. 37 of Ref. [7].

In 1947, contrary to Dirac's predictions, Lamb discovered a 1000 MHz shift between the $^2S_{1/2}$ state and the $^2P_{1/2}$ state of the hydrogen atom [24]. This so called Lamb Shift marked the beginning of modern quantum electrodynamics. In the words of Dirac [25], "No progress was made for 20 years. Then a development came initiated by Lamb's discovery and explanation of the Lamb Shift, which fundamentally changed the character of theoretical physics. It involved setting up rules for discarding ...infinities..." Renormalization is presently believed to be required of any fundamental theory of physics [26]. However, dissatisfaction with renormalization has been expressed at various times by many physicists including Dirac [27] who felt that, "This is just not sensible mathematics. Sensible mathematics involves neglecting a quantity when it turns out to be small—not neglecting it just because it is infinitely great and you do not want it!"

Albeit, the Dirac equation did not predict the Lamb shift or the electron g factor [24, 28-29], its feature of negative-mass states of the vacuum gave rise to the postulates of QED that has become a center piece of quantum mechanics to explain these and other similar observations. One of QED's seminal aspects of renormalization which was subsequently grafted into atomic theory was a turning point in physics similar to the decision to treat the electron as a point-particle-probability wave, a point with no volume with a vague probability wave requiring that the electron have an infinite number of positions and energies including negative and infinite energies simultaneously. The adoption of the probabilistic versus deterministic nature of atomic particles violates all physical laws including special relativity with violation of causality as pointed out by Einstein [22] and de Broglie [30]. Consequently, it was rejected even by Schrödinger [31].

Pure mathematics took the place of physics when calculating subtle shifts of the hydrogen atomic energy levels. Moreover, in QED, the pure mathematics approach has been confused with physics to the point that virtual particles are really considered as causing the observable. The justification for the linkage is often incorrectly associated with the usage of series expansion and variational methods to solve problems based on physical laws. But, series expansion of an equation based on a physical action or variation of a physical parameter of the equation versus the fabrication of an action based on fantastical untestable constructs that are represented by a series are clearly different. For example, the motion of a pendulum can be solved exactly in terms of an elliptic integral using Newtonian mechanics.

Expansion of the elliptic integral in a power series and ignoring negligible terms in the series versus setting up of arbitrary rules for *discarding infinities* are clearly not the same. Furthermore, inventing virtual particles that have an action on space, and subsequently on an electron, versus expanding terms in the energy equation due to a gravitating body causing a gravitational field and thus an action on the pendulum are very different. In QED, virtual particles are not merely a substitutional or expansion variable. They are really considered as causing the observable.

In a further exercise of poor science, virtual-particle-based calculations are even included in the determination of the fundamental constants which are circularly used to calculate the parameter ascribed to the virtual particles. For example, using the electron magnetic moment anomaly in the selection of the best value of the fine structure constant, the CODATA publication [32] reports the use of virtual particles:

> "The term A1 is mass independent and the other terms are functions of the indicated mass ratios. For these terms the lepton in the numerator of the mass ratio is the particle under consideration, while the lepton in the denominator of the ratio is the virtual particle that is the source of vacuum polarization that gives rise to the term."

There is no direct evidence that virtual particles exist or that they polarize the vacuum. Even their postulation is an oxymoron.

Throughout the history of quantum theory, wherever there was an advance to a new application, it was necessary to repeat a trial-and -error experimentation to find which method of calculation gave the right answers. Often the textbooks present only the successful procedure as if it followed from first principles and do not mention the actual method by which it was found. In electromagnetic theory based on Maxwell's equations, one deduces the computational algorithm from the general principles. In quantum theory, the logic is just the opposite. One chooses the principle (e.g. phenomenological Hamiltonians) to fit the empirically successful algorithm. For example, we know that it required a great deal of art and tact over decades of effort to get correct predictions out of QED. The QED method of the determination of $(g - 2)/2$ from the *postulated* Dirac equation is based on a *postulated* power series of α / π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term which is processed over decades using ad hoc rules to remove infinities from each term that arises from *postulated* scores of *postulated* Feynman diagrams. The solution so obtained using the perturbation series further requires a *postulated* truncation since the series *diverges*. Mohr and Taylor reference some of the Herculean efforts to arrive at g using QED [32]:

> "the sixth-order coefficient $A_1^{(6)}$ arises from 72 diagrams and is also known analytically

after nearly 30 years of effort by many researchers [see Roskies, Remiddi, and Levine (1990) for a review of the early work]. It was not until 1996 that the last remaining distinct diagrams were calculated analytically, thereby completing the theoretical expression for $A_1^{(6)}$".

For the right experimental numbers to emerge, one must do the calculation (i.e. subtract off the infinities) in one particular way and not in some other way that appears in principle equally valid. For example, Milonni [33] presents a QED derivation of the magnetic moment of the electron which gives a result of the wrong sign and requires the introduction of an

"upper limit K in the integration over $k = \omega / c$ in order to avoid a divergence."

A differential mass is arbitrarily added, then

"the choice $K = 0.42 mc / \hbar$ yields $(g - 2)/2 = \alpha / 2\pi$ which is the relativistic QED result to first order in α. [...] However, the reader is warned not to take these calculations too seriously, for the result $(g - 2)/2 = \alpha / 2\pi$ could be obtained by retaining only the first (radiation reaction) term in (3.112) and choosing $K = 3mc / 8\hbar$. It should also be noted that the solution $K \cong 0.42 mc / \hbar$ of (3.112) with $(g - 2)/2 = \alpha / 2\pi$ is not unique."

Such an ad hoc nonphysical approach makes incredulous:

" the cliché that QED is the best theory we have!" [34]

or the statement that:

"The history of quantum electrodynamics (QED) has been one of unblemished triumph" [35].

There is a corollary, noted by Kallen: from an inconsistent theory, any result may be derived.

In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, a classical approach was explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level [2-7]. Physical laws and intuition are restored when dealing with the wave equation and quantum mechanical problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles that successfully applies physical laws on all scales. Rather than use the postulated Schrödinger boundary condition: "$\Psi \to 0$ as $r \to \infty$", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$-state electron cannot radiate energy.* The electron must be extended rather than a point. On this basis with the assumption that physical laws including Maxwell's equation apply to bound electrons, the hydrogen atom was solved exactly from first principles. The remarkable agreement across the spectrum of experimental results

indicates that this is the correct model of the hydrogen atom.

It was shown previously that quantum mechanics does not explain the stability of the atom to radiation [2]; whereas, the Maxwellian approach gives a natural relationship between Maxwell's equations, special relativity, and general relativity. CQM holds over a scale of spacetime of 85 orders of magnitude—it correctly predicts the nature of the universe from the scale of the quarks to that of the cosmos [3]. A review is given by Landvogt [36]. In a third paper, the atomic physical approach was applied to multielectron atoms that were solved exactly disproving the deep-seated view that such exact solutions can not exist according to quantum mechanics. The general solutions for one through twenty-electron atoms are given in Ref [4]. The predictions are in remarkable agreement with the experimental values known for 400 atoms and ions. A fourth paper presents a solution based on physical laws and fully compliant with Maxwell's equations that solves the 26 parameters of molecular ions and molecules of hydrogen isotopes in closed-form equations with fundamental constants only that match the experimental values [5]. In a fifth paper, the nature of atomic physics being correctly represented by quantum mechanics versus classical quantum mechanics is subjected to a test of internal consistency for the ability to calculate the conjugate observables using the same solution for each of the separate experimental measurements [6]. It is confirmed that the CQM solution is the accurate model of the helium atom by the agreement of predicted and observed conjugate parameters of the free electron, ionization energy of helium and all two electron atoms, ionization energies of multielectron atoms, electron scattering of helium for all angles, and all He I excited states using the same unique physical model in all cases. Over five hundred conjugate parameters are calculated using a unique solution of the two-electron atom without any adjustable parameters. In the closed-form equations, overall agreement is achieved to the level obtainable considering the error in the measurements and in the fundamental constants.

In contrast, the quantum fails utterly. Ad hoc computer algorithms are used to generate meaningless numbers with internally inconsistent and nonphysical models that have no relationship to physics. Attempts are often made to numerically reproduce prior theoretical numbers using adjustable parameters including arbitrary wave functions in computer programs with precision that is often much greater (e.g. 8 significant figures greater) than possible based on the propagation of errors in the measured fundamental constants implicit in the physical problem.

In this sixth paper of a series, rather than invoking renormalization, untestable virtual particles, and polarization of the vacuum by the virtual particles, the results of QED such as the anomalous magnetic moment of the electron, the Lamb Shift, the fine structure and

hyperfine structure of the hydrogen atom, and the hyperfine structure intervals of positronium and muonium (thought to be only solvable using QED) are solved exactly from Maxwell's equations to the limit possible based on experimental measurements.

The Committee's statement, "integers enter automatically in the process of finding the solution of the wave equation," contradicts its own previous statements. First, the SE is not a wave equation, it is a diffusion equation. Second, integers do not arise naturally—they require curve fitting steps. One ad hoc rule is the requirement that the solutions are polynomials; another is that they are selected to match the Rydberg set of lines that were experimentally known for about a generation before the SE was postulated and curve fitted to the known data.

In contrast, using classical laws, Applicant's theory arrives at the best agreement to real world experimental data, as shown in the paper:

R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

The existence of hydrino is further proven by Applicant's extensive data of record. The SE's failure to predict these states is not surprising given that it does not provide a physically correct model of the H atom. Outdated quantum theory is based on mathematical rules **without any physical foundation**.

With regard to the Committee's earlier statement that "[i]t is crucial to note that either approach is but a mathematical tool," it is important to note that the Schrodinger equation is **not** physical since it deals with an all space (everywhere at once) point-particle probability wave. Quantum theory also does not give the correct solution of the energy levels of even the simplest atom, hydrogen, since it misses spin, the electron g factor, the Lamb shift, the fine structure, the hyperfine structure, degeneracy of excited states, lack relativistic invariance, is not stable to radiation of the n=1 state, violates conservation of energy and angular momentum as well as casualty to mention just a few of the fatal flaws as pointed out in previous publications:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4,

December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

2.   R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.

3.   R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

4.   R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

5.   R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

6.   R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

7.   R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.

8.   R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

9.   R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

10.   R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

11.   V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.

12.   P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.

13.   A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.

14.   F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

Beyond the simplest atom, nothing can be solved using outdated quantum theory since the mathematics involves multi-body problems. Approximations with nonphysical assumptions and adjustable parameters are the techniques employed, wherein physics is replaced by untestable pure mathematics. Further, the mathematics associated with quantum theory is obviously internally inconsistent, since no two theoreticians use the same adjustable parameters, and, thus, that flawed theory fails to meet the Committee's own credibility standard.

This ad hoc approach is extended to molecule solutions. For example citing from Applicant's paper [R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389], in Table 9-1, McQuarrie [D. A. McQuarrie, Quantum Chemistry, University Science Books, Mill Valley, CA, (1983), pp. 343-422] presents 13 different methods for the calculation of the parameters of the hydrogen molecule used by outdated quantum theory. None are rigorous, physical, unique, and internally consistent, and the methods are themselves internally inconsistent and often contradictory. The number of terms in the wavefunctions span two to 100 and all involve mixing of the wavefunctions as given in Eq. (3-5) with variable parameters. Exemplary algorithms include valence bond, valence bond plus ionic terms, molecular orbital theory, molecular-orbital with configuration interaction, self consistent field method, SCF-LCAO-MO, Hartree-Fock, valence-shell electron-pair-repulsion (VSEPR) method, etc. In all of these and other such approaches, there is total disregard to conservation of energy, momentum, and radiation according to Maxwell's equations. The approaches involve an inconsistent plethora of invented wavefunctions and terms—Slater orbitals, ionic terms, molecular orbital with sigma bonds, pi bonds, delta bond, banana bonds, bonding orbitals, antibonding orbitals, (negative probability density as well as positive probability density), back-bonding orbitals (empty space), overlap, coulomb, and exchange integrals—all with intractable infinities. Ad hoc, inconsistent types of adjustable parameters such as effective nuclear charge, ionic character, correlation interactions, and arbitrary renormalization procedures to remove infinities are introduced to force the calculations to match observations.

In contrast, Applicant's modern theory uses physical laws to exactly solve the energy levels of atoms, excited states, spin, the electron g factor, the Lamb shift, the fine structure, the hyperfine structure, degeneracy of excited states, relativistic invariance, stability to radiation of the n=1 state, and conservation of energy and angular momentum as given in the above cited references 1-10. These results are extended to give exact solutions of polyatomic molecules as given in Chps. 11, 13 and 14 of Mills GUT, an achievement that is unmatched by SQM.

The experimental confirmation of the hydrino states predicted by classical

physical laws further validates that physical laws apply to the level of the atom and that flawed quantum theory is not the correct theory of the atom.

On page 58 of the Consolidated Appendix, the Committee further incorrectly states:

> Additional evidence to support the examiner's position regarding the extraordinary value of the Schrodinger equation is seen in the following quotation from p. 198 in Merzbacher (1961):
>
>> "Most obviously, we must correct the error made in assuming that the nucleus is infinitely massive and therefore fixed. ... Further, and often more important, corrections are due to the presence of electron spin and the high speed of the electron, which necessitate a relativistic calculation; hyperfine structure effects arise from the magnetic properties of the nucleus; and, finally, there are small but measurable effects owing to the interaction between the electron and the electromagnetic field (Lamb shift). ... *But all are overshadowed in magnitude by the basic gross structure of the spectrum* as obtained in this chapter by the application of nonrelativistic quantum mechanics to the Coulomb potential [i.e. the application of the Schrodinger equation to the hydrogen atom]." Emphasis added.

It is surprising that the Committee touts the treatment of the Coulomb potential by the SE when the SE violates all of the other aspects of Maxwell's equations, including the electrodynamic laws and stability to radiation, as discussed in Mills GUT and the following papers:

1. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498; posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
2. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", submitted.
3. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- Through Twenty-Electron Atoms", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
4. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, Vol. 17, (2004), pp. 342-389, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.
5. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", in press, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

6. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", submitted, posted with spreadsheets at http://www.blacklightpower.com/techpapers.shtml.

7. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," Annales de la Fondation Louis de Broglie, Vol. 30, No. 2, (2005), pp. 129-151; posted at http://www.blacklightpower.com/theory/theory.shtml.

8. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.

9. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

10. R. Mills, The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

11. V. F. Weisskopf, Reviews of Modern Physics, Vol. 21, No. 2, (1949), pp. 305-315.

12. P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.

13. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev., Vol. 47, (1935), p. 777.

14. F. Laloe, Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

H. A. Haus, "On the radiation from point charges", American Journal of Physics, 54, (1986), pp. 1126-1129.

G. Goedecke, Phys. Rev 135B, (1964), p. 281.

J. Daboul and J. H. D. Jensen, Z. Physik, Vol. 265, (1973), pp. 455-478.

P. Pearle, Foundations of Physics, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945.

T. A. Abbott, D. J. Griffiths, Am. J. Phys., Vol. 53, No. 12, (1985), pp. 1203-1211.

Thus, the Committee's arguments are hollow. While SE may have had some value many years ago, modern technology and scientific progress require that flawed SE be abandoned since it does not accurately model the electron and does not take into account the lower energy states. Applicant's modern theory accurately models the electron, including the lower energy states now conclusively proven by the experimental evidence of record that has yet to be fairly considered by the Committee.

On page 58 of the Consolidated Appendix, the Committee further incorrectly states:

The applicant's reference to the "kinetic energy of rotation" is a distortion of basic scientific terminology. It is noted that, according to Schiff (1968) at pp. 81-82, the formula1(1 + 1) $h^2/8sr^2m\sim$ represents a centrifugal potential energy term that is supplied by the potential energy and is the force required to constrain the electron to move in a path around the nucleus. It is thus not a kinetic energy term at all. Additionally, for an electron in an atom the concept of rotational energy lacks meaning. The electron may undergo translational motion but it cannot rotate or vibrate. And, of course, given the fact that the wave function of the electron in the ground state (or "normal" state as referred to by Pauling and Wilson (1985) at p. 139) of the hydrogen atom is spherically symmetric, it is hardly surprising that the angular momentum quantum number, l, is naturally zero for the ground state of the electron.

The applicant's response that the Schrödinger equation predicts the angular momentum of "the ionized electron" to be infinite is erroneous. The ionized electron represents a situation when the electron is no longer "bound" to the nucleus of an atom. Therefore, it is a free particle conventionally represented by the eigenfunction $e^{2\sim}$ with a linear momentum,p E tin. See Schiff (1968) at p. 101. The angular momentum, L, is $I2\sim$, where land w are the moment of inertia and the angular velocity, respectively. Thus, absent evidence that land/or w are infinite, the angular momentum of a free electron cannot be infinite.

The applicant's argument that the Schrodinger equation predicts that the excited state rotational energy levels are nondegenerate does not make any sense in the context of the hydrogen atom which does not have any rotational energy levels.

The applicant's position that the Schrodinger equation predicts that the wave function of a highly excited state electron is infinite is without foundation. In fact, a standard expression for the normalization of a free particle eigenfunction or wave function, r)$\sim$-e'$\sim$ is known as the delta function normalization (note that the bolded symbols designate vectors). See, e.g., Schiff (1968) at pp. 54-57. It is observed that the preceding expression for the free particle eigenfunction or wave function is identical to the one stated previously $(e^{2'}\sim"\sim)$ on p. 43 when r is reduced to the one-dimensional space coordinate, x, given that k E p/h (Schiff (1968) at p. 54). This argument is equally applicable against the applicant's assertion that the ionized electron, which is free particle, cannot be normalized.

Applicant's comments on the Heisenberg Uncertainty Principle and the Correspondence Principle do not indicate as to what their relevance, if any, is to the applicability of Schrodinger's equation to the hydrogen atom.

The comment that the "Schrodinger equation is not consistent with

conservation of energy in an inverse potential field" is clearly off the mark since the Virial Theorem, zâ~. kinetic energy is minus one-half of the potential energy, clearly holds for the Schrodinger equation. In the particular case of the hydrogen atom in which an electron interacts with a proton nucleus *via* a Coulomb potential **(-'-i/i')**, such a demonstration of the Virial Theorem is shown by Pauling and Wilson at pp. 145-146.

Applicant's statement that "the Schrodinger equation permits the electron to exist in the nucleus" is baseless. Such a statement reflects the fact that the applicant has *confused the wave function, çb,* which is required to be *finite* at the nucleus for the *ground state n = 1, 1= 0, with the probability density, 4m~* 10*01, which is zero at the nucleus located at ~ = 0, ~ being the radial space coordinate. It is the probability density, not the wave function, which properly describes the probability of finding the electron. The examiner had specifically pointed this out in **Endnote 1** in the previous office action which is also attached to the present appendix. It is noted that applicant has repeated the same erroneous argument at pp. 48-49 of the amendment and <u>continues to repeat this erroneous argument throughout</u> <u>prosecution history</u>.

Contrary to applicant's response, the issue at hand is the computation of the energy levels of the hydrogen atom not the scattering of electrons from hydrogen. These are two separate problems and present discussion of the Schrodinger equation has been conducted with respect to the former problem.

It is unclear as to what applicant means when he says that the probability wave interpretation "gives rise to infinite magnetic and electric energy in the corresponding fields of the electron." Perhaps, the applicant is referring to the infinite "self-energy" of the electron. But this is also true in classical electromagnetic theory where it arises from the point charge nature of a classical charge. The issue is resolved in quantum electrodynamics by a covariant renormalization procedure as described in Bethe and Salpeter at p. 92 and by Schiff at p. 527.

Applicant's remarks concerning the "unfounded notions" upon which the Dirac equation is allegedly based must be contrasted with one of the most spectacular achievements of that equation *ut.* the prediction of a new particle, the positron, an antiparticle to the electron. And, in fact, Anderson first experimentally detected the positron in 1932 just as had been predicted by the Dirac equation. [Footnote omitted.] See Heitler at p. 111.

It is apparent that the success of quantum mechanics with its sequence of increasingly refined and powerful theories whose predictions have been confirmed by many experiments over decades of scientific

research in this past century outweighs the criticisms leveled against it by the applicant. In the words of a classic graduate level textbook, Schiff at p. 1, cited earlier in ~ 2:

> "At the present stage of human knowledge, quantum mechanics can be regarded as the _fundamental_ theory of atomic phenomena". Emphasis added.

With respect to the alleged "fatal flaw" in the Dirac equation (see p. 52 of the amendment), the paper entitled "Recent developments in the theory of the electron," cited by applicant, points out that the theory of Quantum Electrodynamics, as originally developed by Tomonaga, Schwinger and Feynman (who jointly received the Nobel Prize in Physics in 1965 for this work) upon a framework _created by Dirac's equation,_ is verified by experiments. That is, zero-point oscillation and the magnetic moment of the electron are successfully predicted by that theory. The paper implies that a "classical" theory of the kind envisioned by the applicant could _not_ predict positrons and that the energy levels of electrons in an atom can be calculated without any assumptions regarding the "inner" structure of the electron.

First, the nomenclature "centrifugal potential energy" used by the Committee is nonsensical. Centrifugal energy corresponds to motion and kinetic energy. Thus, outdated quantum theory makes inescapable predictions that do not match observations. For example, at page 365 Margenau and Murphy [34] state:

" but with the term $\dfrac{\ell(\ell+1)\hbar^2}{2mr^2}$ added to the normal potential energy. What is the meaning of that term? In classical mechanics, the energy of a particle moving in three dimensions differs from that of a one-dimensional particle by the kinetic energy of rotation, $\dfrac{1}{2}mr^2\omega^2$. This is precisely the quantity $\dfrac{\ell(\ell+1)\hbar^2}{2mr^2}$, for we have seen that $\ell(\ell+1)\hbar^2$ is the _certain_ value of the square of the angular momentum for the state Y_ℓ, in classical language $\left(mr^2\omega^2\right)^2$ which is divided by $2mr^2$, gives exactly the kinetic energy of rotation."

Zero rotational energy and zero angular momentum are predicted for the n=1 state using outdated quantum theory, which is impossible since the electron is bound in a Coulomb field and must have nonzero instantaneous motion. Thus, the Schrödinger equation solutions further predict that the ionized electron may have infinite angular momentum. The

Schrödinger equation solutions also predict that the excited state rotational energy levels are nondegenerate as a function of the ℓ quantum number even in the absence of an applied magnetic field, and the predicted energy is over six orders of magnitude of the observed nondegenerate energy in the presence of a magnetic field. In the absence of a magnetic field, no preferred direction exists. In this case, the ℓ quantum number is a function of the orientation of the atom with respect to an arbitrary coordinate system. Therefore, the nondegeneracy is nonsensical and violates conservation of angular momentum of the photon.

34. H. Margenau, G. M. Murphy, *The Mathematics of Chemistry and Physics*, D. Van Nostrand Company, Inc., New York, (1956), Second Edition, pp. 363-367.

These inescapable predictions of the Schrodinger equation which are not observed disprove it as reported in Mills Gut and the following papers:

113.R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", New Journal of Physics, submitted.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

The Schrodinger equation predicts that the highly exited states are over all space, are infinite, and can not be normalized. This unfortunate failure is honestly admitted to in the textbook by H. Margenau, G. M. Murphy, The Mathematics of Chemistry and Physics, D. Van Nostrand Company, Inc., New York, (1943) pp. 363-367.

These failures of the Schrodinger equation as well as those regarding the electron angular momentum and kinetic energy cannot be dismissed by the Committee. They are directly predicted by the Schrodinger equation. Adding ad hoc free-space delta functions and other non justifiable add-ons cannot save outdated quantum theory. The failures are discussed in detail in the following papers:

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum

Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

An excerpt from the following paper presents the inescapable problem including the infinite nature of the highly excited-state electron predicted directly by the Schrodinger equation:

5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

Schrodinger Theory of the Hydrogen Atom

In 1923, de Broglie suggested that the motion of an electron has a wave aspect—$\lambda = \frac{h}{p}$. This was confirmed by Davisson and Germer in 1927 by observing diffraction effects when electrons were reflected from metals. Schrodinger reasoned that if electrons have wave properties, there must be a wave equation that governs their motion. And, in 1926, he proposed the time independent Schrodinger equation

$$H\Psi = E\Psi \tag{28}$$

where Ψ is the wave function, H is the wave operator, and E is the energy of the wave. To give the sought three quantum numbers, the Schrodinger equation solutions are three dimensional in space and four dimensional in spacetime

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\delta^2}{\delta t^2}\right]\Psi(r,\theta,\phi,t) = 0 \tag{29}$$

where $\Psi(r,\theta,\phi,t)$ according to quantum theory is the probability density function of the electron as described below. When the time harmonic function is eliminated [3],

$$-\frac{\hbar^2}{2\mu}\left[\frac{1}{r^2}\frac{\delta}{\delta r}\left(r^2\frac{\delta\Psi}{\delta r}\right) + \frac{1}{r^2\sin\theta}\frac{\delta}{\delta\theta}\left(\sin\theta\frac{\delta\Psi}{\delta\theta}\right)_{r,\phi} + \frac{1}{r^2\sin^2\theta}\left(\frac{\delta^2\Psi}{\delta\phi^2}\right)_{r,\theta}\right] + V(r)\Psi(r,\theta,\phi) = E\Psi(r,\theta,\phi) \tag{30}$$

where the potential energy $V(r)$ in CGS units is

$$V(r) = -\frac{e^2}{r} \tag{31}$$

The Schrodinger equation (Eq. (30)) can be transformed into a sum comprising a part that depends only on the radius and a part that is a function of angle only obtained by separation

of variables and linear superposition in spherical coordinates. The general form of the solutions for $\psi(r,\theta,\phi)$ are

$$\psi(r,\theta,\phi) = \sum_{l,m} R_{nlm}(r)Y_{lm}(\theta,\phi) \tag{32}$$

where l and m are separation constants. The azimuthal (theta) part of Eq. (30) is the generalized Legendre equation which is derived from the Laplace equation by Jackson (Eq. (3.9) of Jackson [4]). The solutions for the full angular part of Eq. (30), $Y_{lm}(\theta,\phi)$, are the spherical harmonics

$$Y_{lm}(\theta,\phi) = \sqrt{\frac{(2l+1)(l-m)!}{4\pi(l+m)!}} P_l^m(\cos\theta)e^{im\phi} \tag{33}$$

By substitution of the eigenvalues corresponding to the angular part [5], the Schrodinger equation becomes the radial equation, $R(r)$, given by

$$-\frac{\hbar^2}{2mr^2}\frac{d}{dr}\left(r^2\frac{dR}{dr}\right) + \left[\frac{\hbar^2 l(l+1)}{2mr^2} + V(r)\right]R(r) = ER(r) \tag{34}$$

The time independent Schrodinger equation is similar to Eq. (20) except that the solution is for the distribution of a spatial wavefunction in three dimensions rather than the dynamical motion of a point particle of mass m along a one dimensional trajectory. Electron motion is implicit in the Schrodinger equation. For wave propagation in three dimensions, the full time dependent Schrodinger equation is required; whereas, the classical case contains time derivatives. The kinetic energy of rotation is K_{rot} is given classically by

$$K_{rot} = \frac{1}{2}mr^2\omega^2 \tag{35}$$

where m is the mass of the electron. In the time independent Schrodinger equation, the kinetic energy of rotation K_{rot} is given by

$$K_{rot} = \frac{\ell(\ell+1)\hbar^2}{2mr^2} \tag{36}$$

where

$$L = \sqrt{\ell(\ell+1)\hbar^2} \tag{37}$$

is the value of the electron angular momentum L for the state $Y_{lm}(\theta,\phi)$.

In the case of the ground state of hydrogen, the Schrodinger equation solution is trivial for an implicit circular bound orbit which determines that the eccentricity is zero, and with the specification that the electron angular momentum is Planck's constant bar. With $k = e^2$, Eq. (25) in CGS units becomes

$$E = -\frac{1}{2}\frac{me^4}{\hbar^2} = -\frac{e^2}{2a_0} \tag{38}$$

which corresponds to $n = 1$ in Eq. (27). Many problems in classical physics give three

quantum numbers when three spatial dimensions are considered. In order to obtain three quantum numbers, the Schrodinger equation requires that the solution is for the distribution of a spatial wavefunction in three dimensions with implicit motion rather than a one dimensional trajectory of a point particle as shown below. However, this approach gives rise to predictions about the angular momentum and angular energy which are not consistent with experimental observations as well as a host of other problems which are summarized in the Discussion Section.

The radial equation may be written as

$$\frac{d}{dr}\left(r^2\frac{dR}{dr}\right) + \frac{2mr^2}{\hbar^2}\left[E - V(r) - \frac{l(l+1)\hbar^2}{2mr^2}\right]R(r) = 0 \tag{39}$$

Let $U(r) = rR(r)$, then the radial equation reduces to

$$U'' + \frac{2m}{\hbar^2}\left[E - V(r) - \frac{l(l+1)\hbar^2}{2mr^2}\right]U = 0 \tag{40}$$

where

$$\psi = \frac{1}{r}U_{lm}(r)Y_{lm}(\theta,\phi) \tag{41}$$

Substitution of the potential energy given by Eq. (31) into Eq. (40) gives for sufficiently large r

$$U''_\infty - \left(\frac{\alpha}{2}\right)^2 U = 0 \tag{42}$$

provided we define

$$\left(\frac{\alpha}{2}\right)^2 = \frac{-2mE}{\hbar^2} \tag{43}$$

where α is the eigenvalue of the eigenfunction solution of the Schrodinger equation given *infra* having units of reciprocal length and E is the energy levels of the hydrogen atom. To arrive at the solution which represents the electron, a suitable boundary condition must be imposed. Schrodinger postulated a boundary condition: $\Psi \rightarrow 0$ as $r \rightarrow \infty$, which leads to a purely mathematical model of the electron. This equation is not based on first principles, has no validity as such, and should not be represented as so. The right hand side of Eq. (43) must be *postulated* in order that the Rydberg equation is obtained as shown below. The postulate is implicit since Eq. (43) arises from the Schrodinger equation which is postulated. It could be defined *arbitrarily*, but is justified because it gives the Rydberg formula. That Schrodinger guessed the accepted approach is not surprising since many approaches were contemplated at this time [6], and since none of these approaches were superior, Schrodinger's approach prevailed.

The solution of Eq. (42) that is consistent with the boundary condition is

$$U_{\infty} = c_1 e^{(\alpha/2)r} + c_2 e^{-(\alpha/2)r} \tag{44}$$

In the case that α is real, the energy of the particle is negative. In this case U_{∞} will not have an integrable square if c_1 fails to vanish wherein the radial integral has the form

$$\int_0^{\infty} R^2 r^2 dr = \int U_{\infty}^2 dr \tag{45}$$

It is shown below that the solution of the Schrodinger corresponds to the case wherein c_1 fails to vanish. Thus, the solutions with sufficiently large r are infinite. The same problem arises in the case of a free electron that is ionized from hydrogen. If α is imaginary, which means that E is positive, Eq. (42) is the equation of a linear harmonic oscillator [7]. U_{∞} shows sinusoidal behavior; thus, the wavefunction for the free electron can not be normalized and is infinite. In addition, the angular momentum of the free electron is infinite since it is given by $\ell(\ell+1)\hbar^2$ (Eq. (37)) where $\ell \to \infty$.

In order to solve the bound electron states, let

$$E = -W \tag{46}$$

so that W is positive. In Eq. (39), let $r = x/\alpha$ where α is given by Eq. (43).

$$x\frac{d^2 R}{dx^2} + 2\frac{dR}{dx} + \left[\frac{2me^2}{\hbar^2\alpha} - \frac{x}{4} - \frac{l(l+1)}{x}\right]R = 0 \tag{47}$$

Eq. (47) is the differential equation for associated Laguerre functions given in general form by

$$xy'' + 2y' + \left[n* - \frac{k-1}{2} - \frac{x}{4} - \frac{k^2-1}{4x}\right]y = 0 \tag{48}$$

which has a solution possessing an integrable square of the form

$$y = e^{-x/2}x^{(k-1)/2}L_{n*}^k(x) \tag{49}$$

provided that $n*$ and k are positive integers. However, $n*$ does not have to be an integer, it may be any *arbitrary* constant β. Then the corresponding solution is [8]

$$y = e^{-x/2}x^{(k-1)/2}\frac{d^k}{dx^k}L_{\beta}(x) \tag{50}$$

In the case that $n*$ is chosen to be an integer in order to obtain the Rydberg formula, $n*-k \geq 0$ since otherwise $L_{n*}^k(x)$ of Eq. (49) would vanish. By comparing Eq. (47) and Eq. (48),

$$\frac{k^2-1}{4} = \ell(\ell+1) \tag{51}$$

Thus,

$$k = 2\ell + 1 \tag{52}$$

and

$$n* - \frac{k-1}{2} = n* - \ell = \frac{me^2}{\hbar}\left(\frac{\alpha}{2}\right)^{-1} \tag{53}$$

Substitution of the value of α and solving for W gives

$$W = \frac{1}{2} \frac{me^4}{(n*-\ell)^2 \hbar^2} \qquad (54)$$

Because of the conditions on $n*$ and k, the quantity $n*-\ell$ can not be zero. It is usually denoted by n and called the principal quantum number. The energy states of the hydrogen atom are

$$W_n = -E_n = \frac{1}{2} \frac{me^4}{n^2 \hbar^2} \qquad (55)$$

and the corresponding eigenfunctions from Eq. (49) are

$$R_{n,\ell} = c_{n,\ell} e^{-x/2} x^\ell L_{n+\ell}^{2\ell+1}(x) \qquad (56)$$

where the variable x is defined by

$$x = \alpha r = \frac{\sqrt{8mW}}{\hbar} r = \frac{2me^2}{n\hbar^2} r \qquad (57)$$

In the Bohr theory of the hydrogen atom, the first orbital has a radius in CGS units given by

$$a_0 = \frac{\hbar^2}{me^2} = 0.53 \; X10^{-8} \; cm \qquad (58)$$

Thus, $\alpha = 2/na_0$ and

$$x = \frac{2}{n} \frac{r}{a_0} \qquad (59)$$

The energy states of the hydrogen atom in CGS units in terms of the Bohr radius are given by Eq. (27). From Eq. (56), $R_{n,\ell}$ for the hydrogen atom ground state is

$$R_{1,0} = c_{1,0} e^{-r/a_0} L_1^1 = 2a_0^{-3/2} e^{-r/a_0} \qquad (60)$$

For this state

$$Y_{00} = cons \tan t = (4\pi)^{-1/2} \qquad (61)$$

when the function is normalized. Thus, the ground state function is

$$\psi_0 = (\pi a_0^3)^{-1/2} e^{-r/a_0} \qquad (62)$$

Immediately further problems arise. Since ℓ must equal zero in the ground state, the predicted angular energy and angular momentum given by Eq. (36) and Eq. (37), respectively, are zero which are experimentally incorrect. In addition, different integer values of ℓ exist in the case of excited electron states. In these cases, the Schrodinger equation solutions, Eq. (36) and Eq. (37), predict that the excited state rotational energy levels are nondegenerate as a function of the ℓ quantum number even in the absence of an applied magnetic field. Consider the case of the excited state with $n = 2$; $\ell = 1$ compared to the experimentally degenerate state $n = 2$; $\ell = 0$. According to Eq. (37) the difference in angular energy of these two states is $3.4 \; eV$ where the expectation radius, $4a_0$, is given by the squared integral of Eq. (70) over space. Thus, the predicted rotational energy in the absence

of a magnetic field is over six orders of magnitude of the observed nondegenerate energy $(10^{-7} - 10^{-6} \ eV)$ in the presence of a magnetic field.

The potential energy of the electron is infinite when it is inside of the nucleus according to the permissible radii of quantum mechanics. According to the Committee, the kinetic energy would be negative infinity, an unquestionable violation of conservation of energy.

As demonstrated throughout the prosecution history of this case, the Committee continues to be in a state of denial that the nucleus experimentally has a finite volume and the electron exists inside of this volume according to quantum mechanics.

The probability density of the 1s orbital of SQM is a maximum at r=0 as shown in Table 6-5 of McQuarrie, pg. 224. Since the radius of nuclei are not zero rather typically 5 X 10^-15 m (Beiser, A., *Concepts of Modern Physics*, Fourth Edition, McGraw-Hill Book Company, New York, (1978), p. 409) the probability that the electron is in the nucleus is finite. Since this requires the electron to have infinite energy, SQM is fatally flawed.

From 17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096:

According to quantum mechanics, the existence of the electron in the nucleus is the basis of spin-nuclear coupling called Fermi contact interaction [103] where $4\pi r^2 \Psi^2 dr$ is not zero since the Ψ^2 is not zero and the nucleus is comprised of baryons. According to the Standard Model, baryons as opposed to leptons have structure, contain more fundamental particles--namely quarks and gluons, and are not point particles. For example, the proton has an experimentally measured radius of $r_p = 1.3 \ X \ 10^{-15} \ m$. The spin-nuclear coupling energy is of the order of $10^{-24} \ J$ despite the infinite Coulombic energy of the electron when found in the nucleus (i.e. $r \rightarrow 0$ in the Schrodinger equation). This consequence of quantum mechanics is further flawed since this state is experimentally disproved. The nucleus does not contain electrons [104]. Since the electron has no volume, based on this logic, the probability that an electron can capture a photon to form an excited state is zero. This internal inconsistency based on the description of the electron as a point particle probability wave does not arise in Mills classical theory of quantum mechanics. The spin nuclear energies are calculated by Mills in closed form based on first principles without the

requirement that the electron is in the nucleus [105] and are in close agreement with the experimental results.

103. M. Karplus and R. N. Porter, *Atoms and Molecules an Introduction for Students of Physical Chemistry*, The Benjamin/Cummings Publishing Company, Menlo Park, California, (1970), p. 567.

104. Beiser, A., *Concepts of Modern Physics*, Fourth Edition, McGraw-Hill Book Company, New York, (1978), p. 407.

105. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, January 2000 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com, pp. 98-109.

Furthermore, the point-particle electron of outdated quantum theory has infinite self energy in its electric and magnetic fields. Mathematically renormalizing does not PHYSICALLY remove infinities. In contrast, Applicant's modern theory predicts the electron is a two-dimensional sphere that has no infinities and does not require a physically baseless renormalization procedure, as discussed in Appendix IV of Mills GUT.

In addition, the Dirac equation did not predict the positron. The opposite-sign-square-root solution was initially interpreted as the proton as given in Beiser [Beiser, A., Concepts of Modern Physics, Fourth Edition, McGraw-Hill, New York, (1987). p. 527].

Outdated quantum theory cannot predict the existence of fundamental particles; nor can it predict their masses. In fact, according to the HUP, fundamental particles of precise masses cannot exist. In contrast, Applicant's modern theory, CQM, predicts the existence and masses of fundamental particles in closed-form equations with fundamental constants only to the limit they can be experimentally measured. The results are given in Chp of Mills GUT Chps 27, 28, and 29. Papers reporting these results are:

58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, Vol. 16, No. 4, December, (2003), pp. 433-498.

113.R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", New Journal of Physics, submitted.

From paper 113:

III. Conclusion

SQM has never dealt with the nature of fundamental particles. Rather, it postulates the impossible situation that they occupy no volume; yet are everywhere at once. In contrast, using the classical wave equation with the constraint of nonradiation based on Maxwell's equations, CQM gives closed-form physical solutions for the electron in atoms, the free electron, and excited states which match the observations. With these solutions, conjugate parameters can be solved for the first time, and atomic theory is at last made predictive and intuitive. Application of Maxwell's equations precisely predicts hundreds of fundamental spectral observations in exact equations with no adjustable parameters (fundamental constants only). Moreover, unification of atomic and large scale physics, the ultimate objective of natural theory, is enabled. The result gives a natural relationship between Maxwell's equations, special relativity, and general relativity. CQM holds over a scale of spacetime of 85 orders of magnitude—it correctly predicts the nature of the universe from the scale of the quarks to that of the cosmos.

In this paper, a summary of the results of CQM [2-11] was presented. (The details of the derivations are given in Ref. [7].) Specifically, CQM gives closed form solutions for the atom including the stability of the $n = 1$ state and the instability of the excited states, the equation of the photon and electron in excited states, the equation of the free electron, and photon which predict the wave particle duality behavior of particles and light. The current and charge density functions of the electron may be directly physically interpreted. For example, spin angular momentum results from the motion of negatively charged mass moving systematically, and the equation for angular momentum, $\mathbf{r} \times \mathbf{p}$, can be applied directly to the wave function (a current density function) that describes the electron. The magnetic moment of a Bohr magneton, Stern Gerlach experiment, g factor, Lamb shift, resonant line width and shape, selection rules, correspondence principle, wave particle duality, excited states, reduced mass, rotational energies, and momenta, orbital and spin splitting, spin-orbital coupling (fine structure), Knight shift, and spin-nuclear coupling (hyperfine structure), muonium hyperfine structure interval, ionization energies of multielectron atoms, elastic electron scattering from helium atoms, and the nature of the chemical bond are derived in closed form equations based on Maxwell's equations. The calculations agree with experimental observations.

For any kind of wave advancing with limiting velocity and capable of transmitting signals, the equation of front propagation is the same as the equation for the front of a light wave. By applying this condition to electromagnetic and gravitational fields at particle production, the Schwarzschild metric (SM) is derived from the classical wave equation which modifies general relativity to include conservation of spacetime (See Ref. [7], Chp. 23 and footnote 7 of Chp. 23), in addition to momentum and matter/energy. The result gives a natural relationship between Maxwell's equations, special relativity, and general relativity. It gives gravitation from the atom to the cosmos. The universe is time harmonically oscillatory in matter energy and spacetime expansion and contraction with a minimum radius that is the gravitational radius. In closed form equations with fundamental constants only, CQM gives the deflection of light by stars, the precession of the perihelion of Mercury, the particle masses, the Hubble constant, the age of the universe, the observed acceleration of the expansion, the power of the universe, the power spectrum of the universe, the microwave background temperature, the uniformity of the microwave background radiation at 2.7 K with

the microkelvin spatial variation observed by the DASI, the observed violation of the GZK cutoff, the mass density, the large scale structure of the universe, and the identity of dark matter which matches the criteria for the structure of galaxies. In a special case wherein the gravitational potential energy density of a blackhole equals that of the Planck mass, matter converts to energy and spacetime expands with the release of a gamma ray burst. The singularity in the SM is eliminated.

The Maxwellian approach allows to the solution of previously intractable problems such as the equations of the masses of fundamental particles. Exemplary relations between fundamental particles are shown in Table 13.

Table 13. The relations between the lepton masses and neutron to electron mass ratio are given in terms of the dimensionless fine structure constant α only.

$$\frac{m_\mu}{m_e} = \left(\frac{\alpha^{-2}}{2\pi}\right)^{\frac{2}{3}} \frac{\left(1+2\pi\frac{\alpha^2}{2}\right)}{\left(1+\frac{\alpha}{2}\right)} = 206.76828 \qquad (206.76827)^a$$

$$\frac{m_\tau}{m_\mu} = \left(\frac{\alpha^{-1}}{2}\right)^{\frac{2}{3}} \frac{\left(1+\frac{\alpha}{2}\right)}{\left(1-4\pi\alpha^2\right)} = 16.817 \qquad (16.817)$$

$$\frac{m_\tau}{m_e} = \left(\frac{\alpha^{-3}}{4\pi}\right)^{\frac{2}{3}} \frac{\left(1+2\pi\frac{\alpha^2}{2}\right)}{\left(1-4\pi\alpha^2\right)} = 3477.2 \qquad (3477.3)$$

$$\frac{m_N}{m_e} = \frac{12\pi^2}{1-\alpha}\sqrt{\frac{\sqrt{3}}{\alpha}} \frac{\left(1+2\pi\frac{\alpha^2}{2}\right)}{\left(1-2\pi\frac{\alpha^2}{2}\right)} = 1838.67 \qquad (1838.68)$$

a Experimental according to the 1998 CODATA and the Particle Data Group [90-91].

It successfully predicted the mass of the top quark before it was reported and correctly predicted the acceleration of the expansion of the universe before it was observed [92]. It further predicts the existence of new states of hydrogen that are lower in energy than the n=1 state that represents a new energy source and a new field of chemistry that has far reaching technological implications in power generation, materials, lighting, and lasers. The existence of such states has been confirmed by the data presented in over 60 published journal articles and over 50 independent tests reports and articles [93].

Having presented the theory of CQM, the misunderstandings and errors of a critique by Rathke [1] were then addressed. Rathke missed the use of the stability to radiation as the constraint to solve the nature of the bound electron. The requirement that the electron

equation of motion obeys a two-dimensional wave equation arises from the constraint that the bound electron does not radiate according to Maxwell's equations. It does not arise from a Bohr-type condition or some wave-particle duality notion. Nothing is waving including probability.

The angular charge-density wave functions given by Eq. (31) are solutions of the two-dimensional wave equation plus time. Rathke has copied the two-dimensional wave equation incorrectly and reversed the sign of the time differential. His other comments about incurable failures are made moot by this careless error.

The equations of motion are the same in all frames. Only the radius is corrected due to relative motion. The equations are relativistically invariant. The azimuthal motion is an inertial frame as supported by many experiments. The correctness of the relativistic radius correction is confirmed by the remarkable agreement between predictions and experiments on numerous experimental observables such as the electron g factor, the invariance of the electron magnetic moment of μ_B and angular momentum of $\hbar$, the Lamb shift, the fine structure and hyperfine structure of the hydrogen atom, the hyperfine structure intervals of positronium and muonium and the relativistically corrected ionization energies of one- and two-electron atoms.

In contradiction to Rathke's claim that excited states can not be solved by CQM, the excited states of hydrogen and now helium are given in closed-form equations with fundamental constants only. These results are derived from Maxwell's equations based on the physical process of excitation of the electron state by the photon. These results can not be reproduced by SQM. Even for the hydrogen excited states, the SQM methodology involves no physics and is arguably simply another form of the Rydberg formula to which it reduces. It is not predictive and is has many consequences that are not in agreement with observations [2-11].

Hydrino states are predicted from Maxwell's equations in an analogous manner as the excited states. The equations of the excited states and hydrino states and the mechanism for their formation are given in contradiction to Rathke's claim. The data including an independent replication under NIAC [94] overwhelmingly demonstrates their existence and the exothermic reaction of their formation.

The Committee has erred in arguing that there is an experimental validation of virtual particles. There is **no** experimental validation of virtual particle, nor is there any evidence that they polarize the vacuum. All QED algorithms do is show that it is possible to force computers to curve fit known numbers.

Furthermore, the Committee makes baseless statements about the success of SQM and QED as discussed previously. The Committee also is in denial that these results can be obtained simply and intuitively using classical laws according to Applicant's theory. Applicant has bettered the results of outdated quantum theory in closed form equations containing fundamental constants only. These solutions are based on the physical structure of the

electron solved from classical laws. To remind the confused Committee, here again is a summary of some of the results from Mills GUT Chps 1, 2, and 21 and the papers

113. R. Mills, "Physical Solutions of the Nature of the Atom, Photon, and Their Interactions to Form Excited and Predicted Hydrino States", New Journal of Physics, submitted.

and

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physics Essays, in press.

The following excerpt from #113 gives the closed-form equations from classical laws, which the Committee states are impossible to achieve:

G. Electron g Factor

As given in the Electron g Factor section of Ref. [7] and Ref. [2], conservation of angular momentum of the orbitsphere permits a discrete change of its "kinetic angular momentum" $(r \times mv)$ by the applied magnetic field of $\dfrac{\hbar}{2}$, and concomitantly the "potential angular momentum" $(r \times eA)$ must change by $-\dfrac{\hbar}{2}$.

$$\Delta L = \frac{\hbar}{2} - r \times eA \tag{57}$$

$$= \left[\frac{\hbar}{2} - \frac{e\phi}{2\pi}\right]\hat{z} \tag{58}$$

In order that the change of angular momentum, ΔL, equals zero, ϕ must be $\Phi_0 = \dfrac{h}{2e}$, the magnetic flux quantum. The magnetic moment of the electron is parallel or antiparallel to the applied field only. During the spin-flip transition, power must be conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \bullet (E \times H) = -\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o H \bullet H\right] - \frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o E \bullet E\right] - J \bullet E \tag{59}$$

Eq. (60) gives the total energy of the flip transition which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively,

$$\Delta E_{mag}^{spin} = 2\left(1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2\right)\mu_B B \tag{60}$$

$$\Delta E_{mag}^{spin} = g\mu_B B \tag{61}$$

where the stored magnetic energy corresponding to the $\frac{\partial}{\partial t}\left[\frac{1}{2}\mu_o \mathbf{H} \bullet \mathbf{H}\right]$ term increases, the

stored electric energy corresponding to the $\frac{\partial}{\partial t}\left[\frac{1}{2}\varepsilon_o \mathbf{E} \bullet \mathbf{E}\right]$ term increases, and the $\mathbf{J} \bullet \mathbf{E}$ term

is dissipative. The spin-flip transition can be considered as involving a magnetic moment of g times that of a Bohr magneton.

The magnetic moment, m, of Eq. (60) is twice that from the gyromagnetic ratio as given by

$$m = \frac{\text{charge} \cdot \text{angular momentum}}{2 \cdot \text{mass}} \tag{62}$$

The magnetic moment of the electron is the sum of the component corresponding to the

kinetic angular momentum, $\frac{\hbar}{2}$, and the component corresponding to the vector potential

angular momentum, $\frac{\hbar}{2}$, (Eq. (57). The spin-flip transition can be considered as involving a

magnetic moment of g times that of a Bohr magneton. The g factor is redesignated the fluxon g factor as opposed to the anomalous g factor, and it is given by Eq. (60).

$$\frac{g}{2} = 1 + \frac{\alpha}{2\pi} + \frac{2}{3}\alpha^2\left(\frac{\alpha}{2\pi}\right) - \frac{4}{3}\left(\frac{\alpha}{2\pi}\right)^2 \tag{63}$$

For $\alpha^{-1} = 137.03604(11)$ [28]

$$\frac{g}{2} = 1.001 \ 159 \ 652 \ 120 \tag{64}$$

The experimental value [29] is

$$\frac{g}{2} = 1.001 \ 159 \ 652 \ 188(4) \tag{65}$$

The calculated and experimental values are within the propagated error of the fine structure constant. Different values of the fine structure constant have been recorded from different experimental techniques, and α^{-1} depends on a circular argument between theory and experiment [30]. One measurement of the fine structure constant based on the electron g factor is $\alpha_g^{-1} = 137.036006(20)$ [31]. This value can be contrasted with equally precise measurements employing solid state techniques such as those based on the Josephson effect [32] ($\alpha_J^{-1} = 137.035963(15)$) or the quantized Hall effect [33] ($\alpha_H^{-1} = 137.035300(400)$). A method of the determination of α^{-1} that depends on the circular methodology between theory and experiment to a lesser extent is the substitution of the independently measured

fundamental constants μ_0, e, c, and h into $\alpha = \frac{\mu_0 e^2 c}{2h}$. The following values of the

fundamental constants are given by Weast [28]

$$\mu_o = 4\pi X 10^{-7} Hm^{-1} \tag{66}$$

$$e = 1.6021892(46) X 10^{-19} C \tag{67}$$

$$c = 2.99792458(12) X 10^8 ms^{-1} \tag{68}$$

$$h = 6.626176(36) \, X \, 10^{-34} \, JHz^{-1} \tag{69}$$

For these constants,

$$\alpha^{-1} = 137.03603(82) \tag{70}$$

Substitution of the α^{-1} from Eq. (70) into Eq. (63) gives

$$\frac{g}{2} = 1.001 \ 159 \ 652 \ 137 \tag{71}$$

The experimental value [29] is

$$\frac{g}{2} = 1.001 \ 159 \ 652 \ 188(4) \tag{72}$$

The *postulated* QED theory of $\frac{g}{2}$ is based on the determination of the terms of a *postulated* power series in α / π where each *postulated* virtual particle is a source of *postulated* vacuum polarization that gives rise to a *postulated* term. The algorithm involves scores of *postulated* Feynman diagrams corresponding to thousands of matrices with thousands of integrations per matrix requiring decades to reach a consensus on the "appropriate" *postulated* algorithm to remove the intrinsic infinities. The remarkable agreement between Eqs. (71) and (72) demonstrates that $\frac{g}{2}$ may be derived in closed form from Maxwell's equations in a simple straightforward manner that yields a result with eleven figure agreement with experiment—the limit of the experimental capability of the measurement of α directly or the fundamental constants to determine α. In Sec. II of Ref. [5] and Chp. 1, Appendix II of Ref. [7], the Maxwellian result is contrasted with the QED algorithm of invoking virtual particles, zero point fluctuations of the vacuum, and negative energy states of the vacuum. Rather than an infinity of radically different QED models, an essential feature is that *Maxwellian solutions are unique and predictive of conjugate parameters.*

Q. Lamb Shift

The Lamb Shift of the $^2P_{1/2}$ state of the hydrogen atom is due to conservation of linear momentum of the electron, atom, and photon. The electron component is

$$\Delta f = \frac{\Delta \omega}{2\pi} = \frac{E_{h\upsilon}}{h} = \frac{(E_{h\upsilon})^2}{2h\mu_e c^2} = 1052.48 \ MHz \tag{130}$$

where $E_{h\upsilon}$ is

$$E_{h\upsilon} = 13.5983 \ eV \left(1 - \frac{1}{n^2}\right) \frac{3}{4\pi} \sqrt{\frac{3}{4}} - h\Delta f \tag{131}$$

$$h\Delta f <<< 10 \ eV \tag{132}$$

Therefore,

$$E_{h\nu} = 13.5983 \ eV\left(1 - \frac{1}{n^2}\right)\frac{3}{4\pi}\sqrt{\frac{3}{4}} \tag{133}$$

The atom component is

$$\Delta f = \frac{\Delta \omega}{2\pi} = \frac{E_{h\nu}}{h} = \frac{(E_{h\nu})^2}{2hm_Hc^2} = \frac{\left(13.5983 \ eV\left(1 - \frac{1}{n^2}\right)\left(1 + \frac{1}{2} - \sqrt{\frac{3}{4}}\right)\right)^2}{2hm_Hc^2} = 5.3839 \ MHz \tag{134}$$

The sum of the components is

$$\Delta f = 1052.48 \ MHz + 5.3839 \ MHz = 1057.87 \ MHz \tag{135}$$

The experimental Lamb Shift [40] is

$$\Delta f = 1057.862 \ MHz \tag{136}$$

Other core results of QED can be replicated using closed-form equations containing fundamental constants only without involving renormalization and virtual particles. The results derived from Maxwell's equations and given in Chps. 2 and 29 of Ref. [7] are in remarkable agreement between the calculated and experimental values that are only limited by the accuracy of the fundamental constants.

R. Fine Structure (Spin-Orbital Coupling)

The fine structure energy is the Lamb-shifted relativistic interaction energy between the spin and orbital magnetic moments due to the corresponding angular momenta. The electron's motion in the hydrogen atom is always perpendicular to its radius; consequently, as shown in Sec. I.D.a, the electron's angular momentum of $\hbar$ given by Eq. (14) is invariant. The angular momentum of the photon given in the Photon Equations section (Sec. I.W) is

$|\mathbf{m}| = \left|\frac{1}{8\pi}\text{Re}[\mathbf{r} \times (\mathbf{E} \times \mathbf{B}^*)]\right| = \hbar$. It is conserved for the solutions for the resonant photons and

excited state electron functions given in the Excited States section (Sec. I.L) and the Photon Equations section (Sec. I.W). Thus, the electrodynamic angular momentum and the inertial angular momentum are matched such that the correspondence principle holds. It follows

from the principle of conservation of angular momentum that $\frac{e}{m_e}$ of Eq. (50) is invariant as

given in the Special Relativistic Correction to the Electron Radius section (Sec. I.D.a) and as shown previously [7]. In the case of spin-orbital coupling, the invariant $\hbar$ of spin angular momentum and orbital angular momentum each give rise to a corresponding invariant magnetic moment of a Bohr magneton, and their corresponding energies superimpose as given in the Orbital and Spin Splitting section (Sec. I.O). The interaction of the two magnetic moments gives rise to a relativistic spin-orbital coupling energy. The vector orientations of the momenta must be considered as well as the condition that flux must be linked by the electron in units of the magnetic flux quantum in order to conserve the invariant electron angular momentum of $\hbar$. The energy may be calculated with the additional conditions of the

invariance of the electron's charge and mass to charge ratio $\frac{e}{m_e}$.

As shown at Eqs. (57-61) in the Electron g Factor section (Sec. I.G), flux must be linked by the electron orbitsphere in units of the magnetic flux quantum. The maximum projection of the rotating spin angular momentum of the electron onto an axis given by Eq.

(55) is $\sqrt{\dfrac{3}{4}}\hbar$. Then, using the magnetic energy term of Eq. (60), the spin-orbital coupling energy $E_{s/o}$ is given by [7]

$$E_{s/o} = 2\frac{\alpha}{2\pi}\left(\frac{e\hbar}{2m_e}\right)\frac{\mu_0 e\hbar}{2(2\pi m_e)\left(\dfrac{r}{2\pi}\right)^3}\sqrt{\frac{3}{4}} = \frac{\alpha\pi\mu_0 e^2\hbar^2}{m_e^2 r^3}\sqrt{\frac{3}{4}} \tag{137}$$

In the case that $n = 2$, the radius given by Eq. (99) is $r = 2a_0$. The predicted energy difference between the $^2P_{3/2}$ and $^2P_{1/2}$ levels of the hydrogen atom, $E_{s/o}$, given by Eq. (137) is

$$E_{s/o} = \frac{\alpha\pi\mu_0 e^2\hbar^2}{8 m_e^2 a_0^3}\sqrt{\frac{3}{4}} \tag{138}$$

As in the case of the $^2P_{1/2}\to^2S_{1/2}$ transition, the photon-momentum transfer for the $^2P_{3/2}\to^2P_{1/2}$ transition gives rise to a frequency shift derived after that of the Lamb shift with $\Delta m_\ell = -1$ included. The energy, E_{FS}, for the $^2P_{3/2}\to^2P_{1/2}$ transition called the fine structure splitting is given by

$$E_{FS} = \frac{\alpha^5(2\pi)^2}{8}m_e c^2\sqrt{\frac{3}{4}} + \left(13.5983\ eV\left(1-\frac{1}{2^2}\right)\right)^2\left[\frac{\left(\dfrac{3}{4\pi}\left(1-\sqrt{\dfrac{3}{4}}\right)\right)^2}{2h\mu_e c^2} + \frac{\left(1+\left(1-\sqrt{\dfrac{3}{4}}\right)\right)^2}{2hm_H c^2}\right]$$

$$= 4.5190\,X\,10^{-5}\ eV + 1.75407\,X\,10^{-7}\ eV \tag{139}$$

$$= 4.53659\,X\,10^{-5}\ eV$$

where the first term corresponds to $E_{s/o}$ given by Eq. (138) expressed in terms of the mass energy of the electron using Eqs. (23.48a-23.48b) of Ref. [7] and the second and third terms correspond to the electron recoil and atom recoil, respectively. The energy of $4.53659\,X\,10^{-5}\ eV$ corresponds to a frequency of $10,969.4\ MHz$ or a wavelength of $2.73298\ cm$. The experimental value of the $^2P_{3/2}-^2P_{1/2}$ transition frequency is $10,969.1\ MHz$ [40-41]. The large natural widths of the hydrogen $2p$ levels limits the experimental accuracy; yet, given this limitation, the agreement between the theoretical and experimental fine structure is excellent.

S. Hyperfine Structure

The hyperfine structure of the hydrogen atom is calculated from the force balance contribution between the electron and the proton [7]. The energy corresponds to the Stern-Gerlach and stored electric and magnetic energy changes. The total energy of the transition from antiparallel to parallel alignment, $\Delta E_{total}^{S/N}$, is given as the sum:

$$\Delta E_{total}^{S/N} = -\mu_0 \mu_B \mu_P \sqrt{\frac{3}{4}} \left(\frac{1}{r_+^3} + \frac{1}{r_-^3} \right) + \frac{-e^2}{8\pi\varepsilon_o} \left[\frac{1}{r_+} - \frac{1}{r_-} \right] + \left(-1 - \left(\frac{2}{3} \right)^2 - \frac{\alpha}{4} \right) 4\pi\mu_o \mu_B^2 \left(\frac{1}{r_+^3} - \frac{1}{r_-^3} \right)$$

$$= -1.918365 \, X \, 10^{-24} \, J + 9.597048 \, X \, 10^{-25} \, J + 1.748861 \, X \, 10^{-26} \, J \qquad (140)$$

$$= -9.411714 \, X \, 10^{-25} \, J$$

where

$$r = a_H \pm \frac{2\pi\alpha\mu_P}{ec} \sqrt{\frac{3}{4}} \qquad (141)$$

The energy is expressed in terms of wavelength using the Planck relationship:

$$\lambda = \frac{hc}{\Delta E_{total}^{S/N}} = 21.10610 \, cm \qquad (142)$$

The experimental value from the hydrogen maser is $21.10611 \, cm$ [42].

T. Muonium Hyperfine Structure Interval

The hyperfine structure of muonium is calculated from the force balance contribution between the electron and muon [7]. The energy corresponds to the Stern-Gerlach and stored electric and magnetic energy changes. The energy of the ground state ($1^2S_{1/2}$) hyperfine structure interval of muonium, $\Delta E(\Delta v_{Mu})$, is given by the sum:

$$\Delta E(\Delta v_{Mu}) = -\mu_0 \mu_B \mu_\mu \sqrt{\frac{3}{4}} \left(\frac{1}{r_{2+}^3} + \frac{1}{r_{2-}^3} \right) + \frac{-e^2}{8\pi\varepsilon_o} \left[\frac{1}{r_{2+}} - \frac{1}{r_{2-}} \right]$$

$$+ 4\pi\mu_o \left(-1 - \left(\frac{2}{3}\cos\frac{\pi}{3} \right)^2 - \alpha \right) \left(\mu_B^2 \left(\frac{1}{r_{2+}^3} - \frac{1}{r_{2-}^3} \right) + \mu_{B,\mu}^2 \left(\frac{1}{r_{1+}^3} - \frac{1}{r_{1-}^3} \right) \right)$$

$$= -6.02890320 \, X \, 10^{-24} \, J + 3.02903048 \, X \, 10^{-24} \, J + 4.23209178 \, X \, 10^{-26} \, J + 1.36122030 \, X \, 10^{-28} \, J$$

$$= -2.95741568 \, X \, 10^{-24} \, J$$

$$(143)$$

where

$$r_2 = a_\mu \pm \frac{2\pi\alpha\mu_\mu}{ec} \sqrt{\frac{3}{4}} \qquad (144)$$

and

$$r_1 = \frac{a_\mu \pm \frac{2\pi\alpha\mu_\mu}{ec} \sqrt{\frac{3}{4}}}{\left(\frac{m_\mu}{m_e} \pm \frac{m_\mu e\alpha c}{2\hbar^2} \mu_0 \mu_\mu \sqrt{\frac{3}{4}} \right)^{1/3}} \qquad (145)$$

Using Planck's equation, the interval frequency, Δv_{Mu}, and wavelength, $\Delta\lambda_{Mu}$, are

$$\Delta v_{Mu} = 4.46330328 \, GHz$$

$$\Delta\lambda_{Mu} = 6.71682919 \, cm$$

$$(146)$$

The experimental hyperfine structure interval of muonium is [43]

$$\Delta E(\Delta v_{Mu}) = -2.957415336 \; X \, 10^{-24} \; J$$

$$\Delta v_{Mu} = 4.463302765(53) \; GHz \; (12 \, ppm) \qquad (147)$$

$$\Delta \lambda_{Mu} = 6.71682998 \; cm$$

U. Positronium Hyperfine Structure

The leptons are at the same radius, and the positronium hyperfine interval is given by the sum of the Stern-Gerlach, $\Delta E_{spin\text{-}spin}$, and fine structure, $\Delta E_{s/o}(^3S_1 \to ^1S_0)$, energies [7]. The hyperfine structure interval of positronium ($^3S_1 \to ^1S_0$) is given by the sum:

$$\Delta E_{\text{Ps hyperfine}} = \Delta E_{spin\text{-}spin} + \Delta E_{s/o}(^3S_1 \to ^1S_0)$$

$$= \frac{g\mu_o e^2 \hbar^2}{8 m_e^2 (2a_0)^3} + \frac{3g\alpha^5 (2\pi)^2}{8} m_e c^2 \sqrt{\frac{3}{4}}$$

$$= \frac{g\alpha^5 (2\pi)^2}{8} m_e c^2 \left(\frac{1}{8\pi\alpha} + \frac{3\sqrt{3}}{2} \right) \qquad (148)$$

$$= 8.41155110 \; X \, 10^{-4} \; eV$$

Using Planck's equation, the interval in frequency, Δv, is

$$\Delta v = 203.39041 \; GHz \qquad (149)$$

The experimental ground-state hyperfine structure interval is [44]

$$\Delta E_{\text{Ps hyperfine}} (\text{experimental}) = 8.41143 \; X \, 10^{-4} \; eV$$

$$\Delta v(\text{experimental}) = 203.38910(74) \; GHz \; (3.6 \, ppm) \qquad (150)$$

On page 62 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant has stated on p. 46 of the amendment that "quantum theory is now in a state of crisis" and has simultaneously referred to an observation that has allegedly "shattered" the "doctrine" of the origin of the universe as a big bang. Such a statement lacks probative value since there is no indication of what the big bang theory has to do with the quantum mechanics of an electron in a hydrogen atom.

The "scientific community" often referred to by the Committee clearly espoused that the universe was created by a big bang and that expansion of the universe was decelerating. Applicant's modern theory accurately predicted more than ten years ago that expansion of the universe was accelerating. This fact further confirms the far greater predictive power of Applicant's modern theory compared to outdated quantum theory.

On page 62 of the Consolidated Appendix, the Committee further erroneously

argues:

> Even if it somehow did, it is contended that applicant's assertion that the big bang theory is "shattered" is incorrect. Thus, attention is drawn to a recent article in *Nature* by Srian and et **al. (2000)** entitled: "The cosmic microwave background radiation temperature at a redshift of 2.34." The article establishes that experimental observations of the ultra-violet and visible spectra of a quasar are in *accord with* value of the temperature of residual radiation as predicted by the big bang theory. Therefore, applicant's linkage of quantum mechanics with a factually erroneous statement regarding the big bang theory has no bearing on the validity of the former.

This argument makes no sense. The article cited by the Committee does not state that the expansion of the universe is decelerating as a result of the big bang. Again, the point is that Applicant's modern theory accurately predicted more than ten years ago that expansion of the universe was accelerating. This fact further confirms the far greater predictive power of Applicant's modern theory compared to outdated quantum theory.

On pages 63-64 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant has submitted declarations from Turner and Dhandapani attesting to experimental support for "hydrino hydride" compounds containing the alleged "hydrino atom." See attachment 50.

> According to paragraph 8 of the Turner declaration, dated May 18, 2000, when applicant's compounds were analyzed using MAS 'H NMR (i.e. "Magic Angle Spinning Proton Nuclear Magnetic Resonance") spectroscopy, signals were observed in the region of -4 to -5 ppm upfield **with** respect to a TMS signal. It is noted that TMS, or tetramethylsilane, is usually used as a standard in this spectroscopy for calibrating signals. The **TMS** signal identifies the "zero" (i.e. 0 ppm) of the scale. The declarant asserts that: "Since **1978** I have been primarily conducting NMR scans and I have never observed signals in the region of -4 to -5 ppm before."

> According to Table 1 in paragraph **14** of the Dhandapani declaration, dated August **14, 2000**, a MAS ^{1}**H NMR spectroscopic analysis of applicant's hydrino** hydride compounds showed "novel features" at signals of -2.5, -3.2, -4.1 and -4.4 ppm. Further, in paragraph 16 Dhandapani asserts that these upfield shifts (from the **TMS** signal) allegedly indicate that "new lower energy states for the hydride ion (hydrino hydride ion) *may* exist."

These declarations are deemed to *lack probative value* for the following reasons:

• Contrary to the assertions of the declarants, upfield shifts in the region from -4 to -5 ppm are <u>known</u> in the prior art. Thus, attention is drawn to Hayashi et al. (1997, Papers *A* - *C*) which disclose a signal of - *4.1± 1.0* ppm for the hydride compound j3-Mg_2NiH_4 in a MAS

^1H NMR spectroscopic experiment using TMS as a standard. See the abstract and p. 67 in Paper "A". This paper provides a factual contradiction of, and shows the error behind the implication of, Turner's assertion that signals of -4 to -5 ppm have "never" been observed other than in applicant's claimed compounds.

• There is a complete break in logic in the implication of the Turner and Dhandapani declarations that since upfield shifts have "never" been observed in the region between -4 to -5 ppm by Turner, therefore, these signals in this region must support the existence of applicant's "hydrino hydride" compounds. The declarants have *not* objectively established that a host of other species, including contaminants, could not have contributed to such signals rather than the alleged "hydrino hydride" compounds.

As stated previously, state-of-the-art elemental, ToF-SIM, and XPS analysis eliminated the possibility that Ni was a contaminant responsible for the upfield-shifted peak. Furthermore, due to the lack of sensitivity of NMR, a major portion of the sample would have to be assignable to the upfield-shifted peak—a distinct impossibility. These results are reported in the Turner affidavit and the following papers:

81. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", European Physical Journal-Applied Physics, Vol. 28, (2004), pp. 83-104.

19. R. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", Int. J. Hydrogen Energy, Vol. 26, No. 9, (2001), pp. 965-979.

10. R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.

8. R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", Int. J. of Hydrogen Energy, Vol. 26, No. 4, (2001), pp. 339-367.

All alternative explanations of the upfield-shifted NMR peak were eliminated as reported in the papers:

112. R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", Central European Journal of Physics, submitted.

111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species $H^-(1/4)$ and $H_2(1/4)$ as a New Power Source", Thermochimica Acta, submitted.

On page 64 of the Appendix, the Committee erroneously argues that:

> Given the importance of these declarations, it is significant that declarant Dhandapani concludes the declaration with a *tentative* suggestion that a "hydrino hydride ion" *may* exist. Surely, if the declarant truly believed that the observed up field shifts are "novel features," why the hesitation in arriving at a positive conclusion? It is noted that declarant Dhandapani is a coworker of applicant and thus the declaration does not constitute independent verification of applicant's experimental results. See for example item numbers 24, 26-33, 35-38, 42, 46, 47, and 49 on pages 62-84 in response filed on 5/23/2005 in U.S. Serial Number 09/669,877 which clearly show Dhandapani to be applicant's coworker.

The vast majority of chemical related patents issued by the U.S. Patent Office are based on experimental evidence prepared by an applicant. The Committee has no legal basis to now exclude all evidence prepared by this Applicant and/or his coworkers. Applicant requests once again that the Committee fairly consider all of the experimental evidence of record.

On pages 64-66 of the Consolidated Appendix, the Committee further incorrectly states:

> With respect to applicant's response regarding his NMR data, the applicant modifies his own NMR evidence of record by submitting a new declaration by Dr. Turner (filed 10/22/2004 in U.S. Application Serial No. 09/669,877). In a previous office action of record (see above), the Examiner rebutted applicant's conclusion that the upfield shifts in his NMR

data are due to the alleged novel hydrino compound by responding that contaminants such as ~3-MgNiH have the same upfield shifts. Dr. Turner's original declaration (dated 5/18/2000) filed on 7/17/2002 in U.S. Application Serial No. 09/669,877 states that he has never observed shifts in the region of—4 to —5 ppm in his 20 years of practicing NMR spectroscopy since 1978 except in applicant's samples. Just because Turner himself never observed shifts in the region from —4 to —5 ppm does not provide positive evidence that these are due to novel compounds and not due to any previously known compounds.

As stated above, the Examiner rebutted this statement in Turner's original declaration by citing references to Hayashi (Hayashi, S. et al. (1997) "Accurate determination of IH Knight shifts in Mg2NiI-Ix and MgHx by means of high-speed magic angle spinning" Journal of Alloys and Compounds, vol. 248, pp. 66-69 (Paper A); Hayashi, S. et al. (1997) "1H NMR and magnetization measurements of a nanostructured composite material of the Mg2Ni-H system synthesized by reactive mechanical grinding," Journal of Alloys and Compounds, vol. 256, pp. 159-165 (Paper ~B); Hayashi, S. et al. (1997), "Local structures and hydrogen dynamics in amorphous and nanostructured Mg-Ni-H systems as studied by IH and 2H nuclear magnetic resonance," Journal of Alloys and Compounds, vol. 261, pp. 145-149 (Paper C)) which show that [3-MgNiH has transitions in the — 4 to —5 ppm region.

In response to the Examiner's evidence of record that ç3-MgNiH have transitions in the —4 to —5 ppm region, Turner now qualifies his original statement in the new declaration by adding a new paragraph that the shifts observed in the region from —4 to —5 ppm are only known to be due to transition metal hydrides such as (3-MgNiH but that Ni and Mg were not detected in applicant's sample. Turner does not provide any additional evidence besides relying on the Examiner's provided evidence of ~3-MgNiH to support his general statement that shifts in the region from —4 to -5 ppm are only known to be due to transition metal hydrides. Turner's current statement now reflects the evidence provided by the Examiner that ~3-MgNiH have transitions in the region of-A to —5 ppm. Turner does not provide any solid evidence to support his general statement that upfield shifts in the —4 to —5 ppm region are known only to be due to transition metal hydrides. It is inaccurate and illogical to extrapolate a piece of prior art provided by the Examiner showing j3-MgNiH having shifts in the —4 to —5 ppm to the general statement that upfield shifts in the —4 to —5 pm region are known only to be due to transition metal hydrides.

Applicant also submitted a letter from Dr. Turner addressed to BlackLight Power, in which Dr. Turner stated:

> In the ^{1}H MAS NMR spectra two unusual signals are observed, at –4.1 and –4.5 ppm. The only compounds know to have chemical shifts in this region are transition metal hydrides, in particular Mg_2NiH_4. Elemental analysis (Galbraith Laboratories, Inc., Knoxville, TN) shows that Mg and Ni are not detected in this sample, and that K is the main metal present. Earlier NMR data has shown that the hydride of K appears at about 1.0 ppm. Therefore, these results suggest that the signals at –4.1 and –4.5 ppm <u>represent a novel species, and do not correspond to a known metal hydride</u>. [Emphasis added.]

Dr. Turner's statement in his letter clearly supports Applicant's previous assertions and makes clear that the observed shifts in the region from —4 to —5 ppm can not be due to any previously known compounds. Furthermore, Mg and Ni were not detected in the samples using elemental analysis and, thus, the Committee's argument that the upfield shift could be due to MgNiH has been conclusively ruled out. The NMR data provided in Dr. Turner's declaration is strong evidence of the existence of Applicant's novel lower-energy hydrogen, which evidence stands unrebutted.

On page 66 of the Consolidated Appendix, the Committee further incorrectly states:

> Furthermore, applicant's and Turner's assertions that there are no contaminants in the sample are not convincing because these samples were not purified after the synthesis process. Applicant's experimental syntheses of K1~I*Cl, KJ~I*Br, and KIF~I*I were made from the corresponding alkali halide KCl, KBr, and K using potassium metal as the catalyst and each compound was prepared in a stainless steel glass cell comprising a Ni screen hydrogen dissociator, catalyst, and alkali halide or alkaline earth hydride (see Experimental section on pp. 966-967 of applicant's paper, Mills et al., "Identification of compounds containing novel hydride ions by nuclear magnetic resonance spectroscopy", <u>International Journal of Hydrogen Energy</u> 26 (2001) pp. 965-979). Ni was used as a hydrogen dissociator and can easily be present as a contaminant such as a nickel hydride containing compound in the resulting products. Turner states in the new declaration that the only compounds known to have chemical shifts at —4.1 and —4.5 ppm are transition metal hydrides. Therefore, it is the Examiner's position that the peaks at —4.1 ppm and —4.5 ppm can be due to minute amounts of contaminants such as a transition metal hydride containing compound in applicant's samples. The Examiner notes that Turner's new declaration modifies the old declaration by changing the pulse angle from 15 to 35 in paragraph 7 and

adding the new paragraph:

"For sample OSO3O4BLPI, in the H MAS NMR spectrum two unusual signals were observed, at —4.1 and —4.5 ppm. The only compounds known to have chemical shifts in this region are transition metal hydrides, in particular Mg2NiH4. Elemental analysis (Gaibraith Laboratories, Inc., Knowville, TN) showed that Mg and Ni are not detected in this sample, and that K was the main metal present. Earlier NMR data has shown that the hydride of K appears at about 1.0 ppm. Therefore, these results suggest that the signals at -4.1 and —4.5 ppm represent a novel species, and do not correspond to any known metal hydride."

This new paragraph in Turner's declaration does not provide conclusive support that these upfield shifts are due to a novel species because all possible known transition compounds other than those including Ni that could have upfield shifts in this region have not been ruled out by the applicant or Turner. This new paragraph only states that K was the main metal present. It silent about what about other metal elements, especially transition metal elements, are present in this sample provided by the applicant.

Furthermore, it is also possible that a previously unstudied, ordinary, non-transition metal hydride compound having upfield shifts is present in the sample.

Finally, applicant and Turner both agree that conventional transition metal hydrides have upfield shifts in the —4 to —5 ppm region. Since these NMR signals are due to the hydrogen atom themselves in these conventional transition metal hydrides as measured by solid state proton NMR, and the position of the signal reflects the surrounding electronic environment of the hydrogen proton, the upfield shifts in these known conventional transition metal hydrides are due to hydrogen protons in a certain electronic environment surrounding the hydrogen protons and are not due to any novel states of the hydrogen atom in the compound. Therefore, upfield shifts of protons in solid state proton NMR are known to be due to the electronic environment of the hydrogen proton that do not involve hydrino form of the hydrogen atom. Hydrinos are not necessary to explain the upfield shifts in solid state H NMR as evidenced by known transition metal hydrides having these upfield shifts in the same region.

As stated above, elemental analysis of the sample conclusively ruled out any contaminates and all other "known transition metal hydrides." The Committee simply ignores this elemental analysis and provides nonsensical explanations that have no basis in fact.

Elemental, ToF-SIM, and XPS analysis eliminated the possibility that Ni was a contaminant responsible for the upfield-shifted peak. Furthermore, due to the lack of sensitivity of NMR, a major portion of the sample would have to be assignable to the upfield-shifted peak—a distinct impossibility. These results are reported in the Turner affidavit and the following papers:

81. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", European Physical Journal-Applied Physics, Vol. 28, (2004), pp. 83-104.

19. R. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", Int. J. Hydrogen Energy, Vol. 26, No. 9, (2001), pp. 965-979.

10. R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.

8. R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", Int. J. of Hydrogen Energy, Vol. 26, No. 4, (2001), pp. 339-367.

All alternative explanations of the upfield-shifted NMR peak were eliminated as reported in the papers:

112. R. L. Mills, J. He, Y. Lu, M. Nansteel, Z. Chang, B. Dhandapani, "Comprehensive Identification and Potential Applications of New States of Hydrogen", Central European Journal of Physics, submitted.

111. R. Mills, J. He, Z. Chang, W. Good, Y. Lu, B. Dhandapani, "Catalysis of Atomic Hydrogen to Novel Hydrogen Species $H^-(1/4)$ and $H_2(1/4)$ as a New Power Source", Thermochimica Acta, submitted.

The Committee has not rebutted this extensive experimental evidence.

On pages 67-68 of the Consolidated Appendix, the Committee further incorrectly states:

Based on the above discussion, it is evident that the Turner and

Dhandapani declarations lack probative value. Furthermore, since the NMR data cited in attachments 7 and 18-22 are underpinned by the veracity of the above declarations, it is evident that these data must be held to be unpersuasive.

Applicant has shown how the Committee's mere conclusions and baseless speculation is wrong. The Committee has provided not even a shred of credible evidence to rebut the Turner and Dhandapani declarations. Applicant once again requests that the Committee fairly consider the experimental evidence of record.

On pages 69-70 of the Consolidated Appendix, the Committee further incorrectly states:

> It is the examiner's position that one of ordinary skill would recognize that apparent excess heat during electrolysis is a phenomenon that cannot be accepted *uncritically*. As evidence, attention is drawn to the following observations in a series of publications by Hansen et al. (1995, 1997, 1998, Papers I - III):

> > "Excess heat could come from unsuspected chemical reactions, mechanical or electrical work, experimental error, nuclear fusion or new chemistry. This paper will present the results of experiments showing that reactions of hydrogen and oxygen at the electrodes probably account for *many* previous observations of excess heat.... *Mills et al. make the only clear claim to such an excess heat rate, but their use of pulsed power and uncertain? about calorimetric accuracy complicates interpretation of their work. ... None* of the publications by Mills et al. contain *details* on the design and construction of their calibration heaters. Electrical calibration of heaters is *notoriously difficult,* particularly at high power." Emphases added. (See pp. 6973-6974 in Paper I.)

> > "Claims of 'excess heat' from measurements of the heat of electrolysis at several watts of power are largely based on use of poorly characterized, isoperibol, heat-conduction calorimeters with single-point temperature sensors. ... Observations of 'excess heat' are *more likely* due to calorimetric errors *than* to violations of the laws of thermodynamics, or to *known or unknown nuclear or chemical reactions."* (Abstract and pp. 14-15 in Paper II.)

> > "Our work shows that, in the absence of extremely vigorous mixing, temperature gradients inside the calorimetric vessel, coupled with failure to measure properly the average wall

> temperature of the calorimetric vessel, can cause *surprisingly large errors in heat rates* calculated with the heat conduction principle. ... Thus, our conclusion that 'faradaic efficiency must be accurately determined and calorimetric accuracy must be demonstrated while the cell is producing excess heat' still stands if *compelling* evidence is to be obtained." (See p. 226 in Paper III.)

Applicant submitted numerous published articles containing highly reliable heat data obtained using state-of-the-art water bath calorimetry. Applicant disclosed all of the parameters. The Committee ignores the accuracy of water bath calorimetry and merely alleges calorimetric errors without basis, which does not amount to evidence. Applicant requests that the Committee stop the nonsense and fairly consider the experimental evidence of record.

Applicant further notes that the Committee now alleges for the first time that his data may violate "laws of thermodynamics." The Committee has not put forth even a shred of evidence to support this baseless statement, nor can it. Applicant has shown where all of the excess heat was obtained, namely by the formation of lower energy states. No classical laws are broken by Applicant's lower energy statesm, whereas outdated quantum theory has been shown to violate those laws.

On page 71 of the Consolidated Appendix, the Committee further incorrectly states:

> In support of inventions involving the "hydrino atom," the applicant has submitted experimental data which are alleged to be explainable by a postulated "hydrino atom." The applicant further claims that experimental calorimetric data obtained by independent agencies such as NASA, Westinghouse STC and Brookhaven National Laboratory support his invention.

> Turning to the data disclosed in the *internal* NASA Technical Memorandum 107167 submitted in attachment 29 of his amendment, it is significant, that even in this case when a party apparently receptive to the applicant's ideas conducted experiments to measure apparent excess heat in an electrolytic cell containing applicant's theorized "hydrino atoms," the outcome was far from being compelling.

> In particular, the NASA memorandum is unpersuasive because the attempted replication of the phenomenon of apparent excess heat in a light water-Ni-K_2CO_3 electrolytic cell simply does not stack up to the test

results from "a private corporation" which, in reality, appears to be applicant's own company. Thus the excess heat of 11 W *maximum* **for the replicated** experiment should be contrasted with the substantially larger excess heat of 50 *W* for a continuous period exceeding hundreds of days for the tests run by the applicant's company (Abstract of the memorandum). It is noteworthy that to the authors of the Memorandum the outcome was such that they concluded that "although our data admits of the existence of an unusual source of heat it falls far short of being compelling." See page 7 of the Memorandum. This is hardly credible evidence of *reproducibility* of scientific data.

"To delimit the alternatives, we have examined **the** following factors considered in the literature as potential causes of multiwatt level, steady state, apparent excess heat in the present type cell:

1. Unrecognized nonlinearity in the cell thermal conductivity at low temperature differential, leading to erroneous extrapolation for the excess heat.

2. Injection of heat into the cell by thermoelectric pumping.

3. Exothermic chemical reactions involving the nickel cathode.

4. Heat from hydrogen-oxygen recombination within the cell."

After further discussion, the authors conclude that: "Following the principle of simplest explanation that fits the data on hand, recombination becomes the explanation of choice." Such a conclusion based on an "ordinary" explanation stands in direct contrast to applicant's belief that the data is explained by the supposed release of heat by the formation of "hydrino atoms."

The Committee again misapprehends the nature of Applicant's comments. **The NASA scientists correctly considered all far-fetched phenomena to explain the results of the observed excess heat and ruled them out.** As summarized on page 7 of the NASA report, all explanations were eliminated except recombination. In the latter case, there was no evidence that recombination occurred, and the limited water-add-back data shown in Figure 8 indicated that recombination was not occurring. The

production of excess energy with a power gain of 1.68 would require 0% Faraday efficiency to account for the observed excess power. 0% Faraday efficiency is very unlikely. The reference to the Jones article is erroneous since Jones used a Ni recombiner material in his cell; whereas, NASA used nickel wire. In addition, the Jones report was also consistent with the observation of excess heat.

The experiments of Mills referenced by Jones[45] [R. Mills; Unification of Spacetime, the Forces, Matter, and Energy, Technomic Publishing Company, Lancaster, PA, 1992, pp. 173-208.] were performed with smooth cold rolled nickel foil or smooth cold drawn nickel wire. Mills has emphasized the importance of using these materials in his publications. For example, Mills reports [Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994)] "The cathode comprised 24 meters of 0.38 mm diameter nickel wire (99 % Alfa # 10249, cold drawn, clean Ni wire)". Whereas, Jones used sintered nickel as described on page 6974 Right Handed Column (RHC). Any excess heat would be less than that of Mills due to the substitution by Jones of an inferior cathode material.

Jones used a recombiner in his experiments and biased the recombination results. Jones states, "It [sintered nickel] is commonly used for filtration of gases and liquids and has a very high surface area compared to Ni foil." It is well known that recombination of gases on nickel is a function of the surface area. The surface area of sintered nickel is orders of magnitude that of smooth nickel foil (the solid nickel foil of Mills was 0.125 mm thick; the sintered porous nickel cathode of Jones was 1 mm thick); thus, the recombination experiments of Jones are irrelevant in the analysis of the results of Mills. Furthermore, Jones admits [page 6973, RHC] "An excess heat rate greater than the total input power, i.e., IE_{cell} can not be attributed to a faradaic efficiency<100%. Mills et al. make the only clear claim to such an excess heat rate". Jones questions the calorimetry of Mills, but Mills' subsequent reports and validating reports from reputable independent laboratories confirm accuracy of his results.

In Experiment # 4 Jones did not follow the protocol of Mills [R. Mills; Unification of Spacetime, the Forces, Matter, and Energy, Technomic Publishing Company, Lancaster, PA, 1992, pp. 177.]:

> As usual in electrochemistry, measures were taken to avoid impurities in the system, especially organic substances. We note here the known problems with the reproducibility of the hydrogen overpotential which can

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[45] Jones, J. E. ,et al., J. Phys. Chem., (1995) Vol. 99, pp. 6973-6979.

be overcome only by ensuring the lowest possible level of impurities. The following procedures were applied in order to reproduce the excess heat effect. The Pt anode was mechanically scoured with steel wool, soaked overnight in concentrated HNO_3, and rinsed with distilled water. The nickel cathode was removed from its container with rubber gloves, and cut and folded in such a way that no organic substances were transferred to the nickel surface. The nickel cathode was dipped into the working solution under electrolysis current and never left in the working solution without electrolysis current. The electrolysis dewar was cleaned with Alconox and 0.1 M nitric acid and rinsed thoroughly with distilled water to remove all organic contaminants.

According to Jones, "In experiment 4, the electrodes were cleaned with a solution of 0.1 M HCl in methanol, and rinsed in distilled water."

Jones reports substantial excess heat with all of the K_2CO_3 experiments which he attributes to experimental error. This conclusion is inconsistent with the data. For experiment 2a, the observation of 110 μW of excess power with an input power of $q_{cell} = 662$ μW can not be attributed to recombination because the gas separation tubes were on during this experiment. Furthermore, no gas was flowing during this experiment. Jones states (page 6975 LHC) "The absolute accuracy in the configuration used for these experiments with several wires and tubes connected through the cell lid is probably better than 10 μW when no gas is flowing through the electrolysis cell." The gases from the electrolysis due to 1.02 milliamps of current are 10 μl / min whereas, the external flow was measured in milliliters per minute (more than 2 orders of magnitude). Experiments 2a, 2b, and 2c were experiments wherein there was no external gas flow. Thus, the absolute accuracy for these experiments "is probably better than 10 μW".

The results presented in Figure 4 indicate that the cell was not at steady state when the data for experiment 2c was recorded. The same pattern is observed in 2c as was observed for 2a. The excess heat is initially negative then steadily climbs to a positive value. At 90 minutes, the excess power is positive. It is not -51 μW as reported in Table 1. The 110 minute data point would be meaningful in the case of experiment 2c. Jones covers the electrodes which causes thermal gradients in the cell (i.e.. the cell is not isothermal) thus, the cell requires a much longer time to reach steady state. The results with gas flow have a much greater error as shown in Figure 3 and

Table 1-experiment 3a ($\pm 100 \ \mu W$). One must not make the mistake of applying this error level to experiments 1 and 2 ($\pm 10 \ \mu W$).

In contrast to the potassium electrolyte cases, Jones reports that when Na_2CO_3 was the electrolyte only a small amount of excess heat was observed. Jones fails to provide the data despite his harsh criticism of the withholding of critical details by other experimenters. This electrolyte switch was a crucial test of the accuracy of Jones' calorimeter which he states as being reproducible to $< 0.5 \ \mu W$; whereas, he dismisses observed excess heat as attributable to $\pm 100 \ \mu W$ error. Moreover, the switch was a crucial test of Mills' reaction wherein potassium is a catalyst and sodium is not. In the Discussion Section, Jones states that the difference between potassium and sodium is due to smaller bubbles in the case of potassium. According to Jones, when a drop of liquid detergent was added to the sodium cell the rate of apparent excess heat was the same; however, in the Results Section he states, "Because the measured heat rate showed large fluctuations, no numerical data are given in Table 1". How can Jones make definite conclusions from such unreliable data that he could not report it? Mills reliably reports the potassium results as well as the results of the sodium control in his publication reference by Jones.

In other cells of the same materials as well as identical cells such as those run at Thermacore Inc. for 15 months, at INEL, and at MIT Lincoln Laboratories, the excess power exceed the input power by substantial multiples and direct measurements were consistent with 100% Faraday efficiency. Thus, with these additional results, the recombination explanation is eliminated as the source of power in these cells. Furthermore, novel compounds containing lower-energy hydrogen were identified from these cells that confirms the claimed catalysis of hydrogen as the source of heat. Recently, the formation of lower-energy hydrogen as the source of heat from these cells was further confirmed by the isolation and NMR identification of lower-energy molecular hydrogen from the electrolysis of a potassium carbonate electrolyte at a hollow nickel cathode.

On page 72 of the Consolidated Appendix, the Committee further incorrectly states:

Another piece of evidence cited to explain "excess heat" by the "hydrino atom" is the experiment conducted and reported out by Peterson of Westinghouse STC, submitted as attachment 38. Note that the "Hydrocatalysis Power Corporation" or HPC referred to in the Westinghouse STC report is none other than an earlier name for the applicant's present "BlackLight Power, Inc." company. Although excess heat from electrolytic cells furnished by HPC was reported, the *credibility* of such a result is *undermined* by Westinghouse STC's identification of *"design problems* with the HPC cells [that] make power balance comparisons *uncertain."* See p. 3 of the report. To make matters worse, the Westinghouse STC report concluded that the "[d]ata provided by HPC were *unconvincing* when reviewed by STC experts."

The Committee fails to consider the fact that since the Westinghouse STC report, Applicant has submitted numerous published articles based on highly reliable water bath calorimetry, which the Committee mostly ignores. The water bath calorimetry data confirms the excess heat data obtained in the Westinghouse STC report. Applicant again requests that the Committee consider the extensive experimental evidence of record instead of nitpicking it.

On pages 72-73 of the Consolidated Appendix, the Committee further incorrectly states:

> More evidence submitted by applicant to support his claim of "excess heat" in a calorimetric experiment is in a letter from the Brookhaven National Laboratory in attachment 44. In this letter, commenting on an experiment by Noninski, the writer states that "I [did *not* check the calibration of his [i.e. Noninski's] equipment nor did I observe his experimental technique in great *detail."* Further on in the letter, the writer concludes that: "The presence of 'excess power' has *not,* however been demonstrated much less 'proved'. A *number* of basic *experiments need to be performed* to eliminate some of the possibilities [i.e. mechanisms other than those based on the postulated 'hydrino atom'] outlined. Finally, there *probably are* many other possible explanations for explaining this thermal anomaly and these would, of course, also *need to be investigated."* Emphases added. It is apparent from the above that the experimental data cited by applicant is simply not probative of patentability for his claimed invention based on the "hydrino atom."

Regarding the Wiesmann study, it reports that calorimetry of continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel

cathode was performed in single cell dewar calorimetry cell by Noninski at Brookhaven National Laboratory.[46] Dr. Weismann observed the experiment and reported the results to Dr. Walter Polansky of the U. S. Department of Energy. Dr. Weismann reports, "The claim is as follows. The temperature rise in the dewar is greater in the case of electrolysis as compared to using a resistor, even though the power dissipated is equal in both cases. According to Applicant's theory, this apparent "excess power" is due to the fact that the electron in a hydrogen atom can "decay" to stable subinteger quantum levels. **Dr. Noninski demonstrated this thermal effect at BNL.**" The observed rise in temperature for a given input power was twice as high comparing electrolysis versus heater power.

Wiesmann was cautious because he did not conduct the experiment himself; although, it was conducted in his laboratory at BNL. The results of the same experiment were published.[47] Dr. Noninski of the Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER) successfully reproduced the results of Mills and Kneizys[48] as a visiting professor at Franklin and Marshall College. A significant increase in temperature with every watt input, compared with the calibration experiment ($\approx 50 \,°C / W$ versus $\approx 30 \,°C / W$), was observed during the electrolysis of potassium carbonate. This effect was not observed when sodium carbonate was electrolyzed. No trivial explanation (in terms of chemical reactions, change in heat transfer properties, etc.) of this effect were found.

The Committee fails to consider the fact that since the Brookhaven report, Applicant has submitted numerous published articles based on highly reliable water bath calorimetry, which the Committee mostly ignores. The water bath calorimetry data confirms the excess heat data obtained in the Brookhaven report. Applicant again requests that the Committee consider the extensive experimental evidence of record instead of nitpicking it.

On page 73 of the Consolidated Appendix, the Committee further incorrectly

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[46] Reference 83.

[47] Reference 59.

states:

> In addition, EarthTech, which is an independent research company, failed to confirm Applicant's claimed result. EarthTech's effort to replicate Applicant's claim is documented at <http://www.earthtech.org/experiments/blp/prelim.html>, and the negative finding at <http://www.earthtech.org/experiments/mills/millsl.htrnl>.

The Committee's reliance on EarthTech is entirely misplaced. EarthTech promotes "infinite energy from vacuum," which Applicant finds incredulous. More specifically, the President/CEO of EarthTech, Dr. Puthoff, is a promoter of "infinite energy from the vacuum," which he claims can be used for power generation, space propulsion, as well as explain the stability of the hydrogen atom. See, for example:

> Puthoff, H.E. , "THE ENERGETIC VACUUM: IMPLICATIONS FOR ENERGY RESEARCH" Speculations in Science and Technology, vol. 13, no. 4,
> pp. 247-257, 1990.

> Puthoff, H.E. , "Gravity as a Zero-Point-Fluctuation Force", Physical Review A, vol. 39, no. 5, pp. 2333-2342, 1 March 1989.

> Puthoff, H.E. , "Source of Vacuum Electromagnetic Zero-Point Energy", Physical Review A, vol. 40, no. 9, pp. 4857-4862, 1 November 1989.

> Puthoff, H.E. , Review A, vol. 44, no. 5, page 3382 and 3385-3386, and an Erratum in Physical Review A, vol. 41, no. 5, page 2902.

> Puthoff, H.E. , "Everything for Nothing", New Scientist, pp. 52-55, 28 July 1990.

> Puthoff, H.E. , "Everything for Nothing"
> http://www.newphys.se/elektromagnum/physics/Puthoff/
> Everything%20for%20Nothing.

> Puthoff, H.E., "Can the Vacuum be Engineered for Spaceflight applications?" http://www.keelynet.com/gravity/putnasa.htm.

> Puthoff, H.E. (1987) "Ground state of hydrogen as a zero-point-fluctuation

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48 Reference 48.

determined state", Phys. Rev. D, Vol. 35, No. 10, pp. 3266-3269.

Also see:

Interview with possible Roswell witness on 07 January 1993
by H.E. Puthoff, Institute of Advanced Studies, Austin, TX
http://www.ufomind.com/misc/1997/jul/d26-001.shtml

Applicant prefers to work within the bounds of classical laws and reality, not the fantasy world of quantum theory and EarthTech. The Committee's alliance with a company like Earth Tech to attack Applicant for making supposedly "incredible" claims reaches new heights of hypocrisy.

Furthermore, Earth Tech is a competitor whom Applicant believes is adversarial. It is possible that they have provided misinformation. Applicant was unaware of the incorrect specifications sourced to EarthTech by the Committee. However, on inspection of the document: "EarthTech's campaign to replicate one of the BlackLight Power excess heat results", on page 3, of the "BLP gas phase replication effort-Run 13" Applicant reads "**our** [emphasis added] detection limit for excess should be put at about 1 or 2 watts." Thus, it appears that the Committee carelessly erred in applying the specifications of EarthTech's instrument to the interpretation of Phillips' data.

Many other independent laboratories including INEL, NASA Lewis, MIT Lincoln Labs, Chalk River, and other have validated Applicant's experiments (See the section entitled "Independent Test Results") that were attempted unsuccessfully by EarthTech, which shows that the failure rests on EarthTech, not Applicant's technology. Furthermore, the Committee fails to consider the fact that since the Earth Tech report, Applicant has submitted numerous published articles based on highly reliable water bath calorimetry, which the Committee mostly ignores. Applicant again requests that the Committee consider the extensive experimental evidence of record instead of nitpicking it.

On pages 74-75 of the Consolidated Appendix, the Committee further incorrectly states:

A significant experiment, not reported by applicant, conducted to

investigate the possibility of apparent excess heat in an electrolytic cell of the same kind used in the NASA Technical Memorandum, cited in ~ 21 above, is the one described by Shkedi et al. entitled "Calorimetry, excess heat, and Faraday efficiency in Ni-H_2O electrolytic cells." [Footnote omitted.] According to p. 1730 of the article:

> "The application of *highly accurate* and *rigorous calorimetry* as presented in this research combined with *proper accounting for the actual Faraday ej7iciençy* clearly indicate that the apparent excess heat observed in these experiments *is a result of neglected conventional chemistry. This conclusion is supported by the lack of any excess heat in the closed cells as well."* Emphasis added.

Moreover, according to the abstract on p. 1720 of the article:

> "The measured Faraday efficiency is significantly <l0O%, and *conventional chemistry can account for the entire amount of observed apparent excess heat to within an accuracy of better than* (25%." Emphasis added.

Most tellingly, the article states at pp. 1729-1730 that

> "Even though this research was not intended to test the validity of the Mills and Kneizys theory [cf. **§ ii of this response], the results** obtained lead to a *clear conclusion* as to whether or not the *postulated 'hydrino' atoms* or molecules were formed. ... The lack of any volume increase . . . preclude the formation of any such novel atoms or molecules in these cells."* Emphasis added.

This provides further evidence that not only is applicant's experimental observation of a relatively large amount of apparent excess heat unsupported by others of skill in the present technology, but that, in any event the applicant's flawed theory is also not required to interpret the results of such experiments.

Applicant has now pointed out on numerous occasions that Shkedi did NOT follow Applicant's procedures and, thus, those experimental results are irrelevant. For example, Applicant discloses in Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994):

> As usual in electrochemistry, measures were taken to avoid impurities in the system, especially organic substances. We note here the known problems with the reproducibility of the hydrogen overpotential

> which can be overcome only by ensuring the lowest possible level of impurities. The following procedures were applied in order to reproduce the excess heat effect. Before starting the experiment, the electrolysis dewar was cleaned with Alconox and 0.1 M nitric acid and rinsed thoroughly with distilled water to remove all organic contaminants. The Pt anode was mechanically scoured with steel wool, soaked overnight in concentrated HNO_3, and rinsed with distilled water. The nickel cathode was removed from its container with rubber gloves, and cut and folded in such a way that no organic substances were transferred to the nickel surface. The nickel cathode was dipped into the working solution under electrolysis current and never left in the working solution without electrolysis current.

Shkedi et al. did not follow this procedure. If fact, they did exactly that which was advised against. From Z. Shkedi, et al., "Calorimetry, excess heat, and Faraday efficiency in $Ni - H_2O$ electrolytic cells", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1720-1731 (page 1722, 1st column):

> The nickel coil assembly was cleaned by soaking it in acetone and methanol and was sintered at 1000°C for 2 hrs in an atmosphere of 95% argon/ H_2 at atmospheric pressure.

They also used different materials then those taught by Applicant. Applicant has found that sintered mesh type materials form a gas boundary layer that prevents the potassium ion catalyst which is in the electrolyte from contacting hydrogen atoms on the surface of the electrode. From Z. Shkedi, et al., "Calorimetry, excess heat, and Faraday efficiency in $Ni - H_2O$ electrolytic cells", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1720-1731 (page 1722, 1st column):

> Type B cathodes were made of Fibrex sintered nickel mesh (National Standard, 80% fiber/20% powder) rolled in two layers around the same nickel mandrel as in type a cathodes and secured with two turns of 1-mm nickel wire. Type B cathodes were not cleaned or sintered after assembly.

The Committee states that the observation of recombination by Shkedi et al. implies that Faraday inefficiency may explain excess heat observed by NASA and others. It is important to keep in mind that the cell design of Shkedi et al. was very different from that of NASA and Thermacore. It favored recombination and was in fact

designed to recombine all of the gases as a closed calorimeter when operating in that mode. Even so, Tables I-IV of Shkedi et al. show a range of Faraday efficiencies from 73% to 99%. Whereas, 0%, Faraday efficiency was required in order to explain away the NASA results. The Committee offers no other plausible explanation for the 11 W of excess power observed by NASA.

In cases where Applicant was an advisor, he has a 100% track record of independent laboratories reporting an effect. Furthermore, the Committee fails to consider the fact that since the Shkedi report, Applicant has submitted numerous published articles based on highly reliable water bath calorimetry, which the Committee mostly ignores. Applicant again requests that the Committee consider the extensive experimental evidence of record instead of nitpicking it.

On pages 76-77 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant has submitted a declaration from Phillips, a co-inventor with the applicant in World patent WO 96/42085 (cited on sheet 3 of 15 in the Information Disclosure Statement filed May 21, 1999 in Paper No. 8 of Serial No. 09/009,294), attesting to experimental support for "hydrino" formation in a calorimeter. See attachment 51. According to paragraph 7 of the declaration, an experiment was performed in the gas phase in a Calvet cell type of calorimeter to test applicant's hypothesis that potassium ions would catalyze the conversion of hydrogen atoms to "hydrino atoms" in a manner consistent with applicant's theory. And, according to paragraphs 10 and 21, the hypothesis is, apparently, "consistent with the present results." These results are average power outputs of 0.5868, 0.5959 and 0.6047 Watts, respectively, as shown in Figures 3-5 of the declaration.
>
> The declaration is deemed to *lack probative value* for the following reasons:
>
> • There is no indication of the detection limit of "excess heat" for the Calvet cell type of calorimeter used by Phillips. Without this information, it is not possible to determine if the declarant's results are experimentally meaningful. In paragraph **11, the declarant indicates** that the calorimeter is "similar" to the one described in "earlier reports" dated January **1,** 1996. Since these reports are supplied in attachment 34, the examiner has consulted that attachment only to find that the detection limit is not mentioned. Upon

reviewing the Information Disclosure Statement filed May 21, 1999 (e.g. in Paper No. 8, Serial No. 09/009,294), it is seen that in a report cited by applicant entitled "Earth Tech's campaign to replicate one of the BlackLight Power excess heat results," the detection limit for a vapor phase cell calorimeter of the kind used by Phillips is described to be "about I or 2 watts." See p. 3 of the "BLP gas-phase replication effort — run **13" of** February 18, 1998. It is apparent that since the detection limit of "about I or 2 watts" for the calorimeter *exceeds* the average power output of 0.5868, 0.5959 and 0.6047 Watts measured by Phillips, the conclusion of "excess heat" is *unjustified.*

• The control experiment performed by Phillips, which involved substituting helium (an inert gas) for hydrogen while using a source of potassium ions, fails to show that it is the formation of a "hydrino atom" catalyzed by potassium ions that is responsible for the alleged "excess heat." See paragraph 16 of the declaration. A proper control experiment would have used a different "catalyst," such as sodium ions, for instance, instead of potassium ions, in the presence of hydrogen, based on applicant's belief that sodium ions will not catalyze the formation of "hydrino atom." See, e.g., attachment 39 and p. 72, line 35 of the specification of Serial No. 09/009,294. The use of an improper control experiment raises serious doubts as to the probative value of the declaration.

• According to p. 3 of Phillips' report in attachment 34, cited previously, an attempt to detect "excess heat" according to applicant's predictions failed in an experiment involving a water bath calorimeter. When, as **here, remarkable and unheard-of results are** alleged, it is only proper scientific procedure to confirm the results by a variety of experimental techniques. The failure of the water bath calorimeter experiment thus leaves unresolved the question of whether the results alleged by applicant are truly experimentally verified. By failing to confirm the allegation of success reported in the present declaration, attachment 34 raises a concern as to the probative value of the declaration under discussion.

Dr. Phillips' expert technical capability is established in the Declaration. Clearly, **a person of his stature and knowledge would not make statements beyond the capability of the instrument.** In fact, Phillips has published several peer-reviewed papers using this calorimeter. For example, a description of the calorimeter is in Dr. Phillips's paper entitled, "High-temperature Calvet-type calorimeter for Investigating

water reactions", Review of Scientific Instruments, Vol. 66 (1), January, 1995. In this paper the calorimeter is calibrated, see Figure 4, and the calorimeter demonstrated the ability to measure tenths of joules. In Dr. Phillips' affidavit, the energy measured from BLP materials was stated as 31,000 joules. The energy reported in the affidavit is greater than 100 times the signal to noise for the instrument. In addition, the January 1996 report contains two finger tests that were performed prior to experimentation, see figures 21-1 and 22-1. These finger tests clearly demonstrate the signal to noise characteristics of the instrument. In the same report, the energy balance is stated to hundredths of joules for the experiments, providing further guidance to the sensitivity of the instrument.

Thus, the Committee's position of the rejection the affidavit from a Dr. Phillips who is a Distinguished National Laboratory Professor at the University of New Mexico, Department of Chemical and Nuclear Engineering and a scientist at Los Alamos National Laboratory based on improper information from a third-party competitor or a supposed careless error is shown to be erroneous.

The Committee further fails to consider the fact that since Dr. Phillip's declaration, Applicant has submitted numerous published articles based on highly reliable water bath calorimetry, which the Committee mostly ignores. The water bath calorimetry data confirms the excess heat data obtained in the declaration. Applicant again requests that the Committee consider the extensive experimental evidence of record instead of nitpicking it.

On page 78 of the Consolidated Appendix, the Committee further incorrectly states:

> Attention is drawn to attachment 38 of applicant's amendment. It contains a review of an ESCA (i.e. Electron Spectroscopy for Chemical Analysis) experiment to characterize a nickel electrode on which "hydrino atoms" were allegedly created. The review, by a Westinghouse STC scientist, concludes that:
>
> > "In summary, the ESCA data presented by Mills and Good does *not* provide strong evidence for *fractional* quantum states of hydrogen."

On p. 64 of the amendment, applicant directed the examiner's attention

to various figures obtained by XPS or ESCA which are alleged to show evidence of "fractional" energy levels. These figures, numbers 17, 19, 21 and 29, have been studied but fail to support applicant's contention in view of the following discussion.

It is observed that in photoelectron spectroscopy (whether UPS - ultraviolet photoelectron spectroscopy, XPS - X-ray photoelectron spectroscopy or ESCA) electrons are ejected from their orbitals by incident photons. Measurement of the kinetic energies of the ejected electrons and knowledge of the energies of the incident photons yields a spectrum of ionization (or binding) energies of electrons from various orbitals as evident from Einstein's law of photoelectric effect, *viz.*:

> *Ionization energy of electron Incident photon energy —*
> *Kinetic energy of electron.*

In XPS and ESCA, due to the relatively high incident energies of the photons, inner shell or core electrons are ejected. The spectra are affected by the environment of the atom from which the electron is ejected. The shape of the bands (or peaks) in the spectra are significant in that they provide information about the bonding characteristics of the orbital from which an electron was ejected. For molecules, the shape of the bands are influenced by many factors such as spin-orbit coupling, vibrational fine structure, dissociation, Jahn-Teller effect and exchange and multiplet splitting.

Turning to applicant's spectra as shown in figures 17, 19, 21 and 29, as cited on p. 64 of the amendment, it is immediately evident that some of the assignments are devoid of meaning. Namely, photoelectron spectra conventionally show ionization or binding energies of an electron in a given energy level or orbital and *do not* show transitions between different orbitals or energy levels. Yet such transitions between allegedly fractional quantum number integer energy levels are shown. See, e.g., the transitions indicated as "H (I/14) - H (1/16)" in figure 17 and "H ~(I/I3) - H (I/16)" in figures 19, 21 and 29. Moreover, in figures 21 and 29 such transitions are shown in a portion of the spectrum that is essentially in the noise region and therefore could not have been assigned with confidence.

Applicant cited the XPS or ESCA data to demonstrate the binding energy of the lower energy hydrogen hydrides. The Committee misunderstands or confuses that with the transition energy. The Westinghouse STC scientist cited by the Committee is not a ESCA expert. In contrast, Applicant hired well-known ESCA experts Dr. Miller and Dr. Simmons of the <u>Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh</u>

University, Bethlehem, PA to test the novel hydrides containing lower energy hydrogen.

As stated previously, these ESCA experts found that: "The persistent appearance of a

spectral feature near the predicted binding energy of many of the electrodes used with a

K electrolyte is an encouraging piece of evidence for the existence of reduced energy

state hydrogen." The Committee unfairly ignores the conclusions of qualified experts

and relies upon mere baseless conclusions. Furthermore, Applicant has submitted

extensive experimental data, including more recent ESCA data that the Committee

simply ignores.

On page 79 of the Consolidated Appendix, the Committee further incorrectly
states:

> Moreover, in light of the preceding discussion regarding the factors that
> affect band shapes and the assignments, it would have been a reasonable
> expectation on the part of one of ordinary skill in the art that applicant
> would have provided such details instead of exhibiting a *conclusionary*
> assignment of transitions to various peaks some of which are hardly
> visible. In view of the confusion engendered by applicant's spectra, it is
> deemed that they lack probative value.

As discussed above, the Committee's arguments are flawed. Applicant, and

highly skilled scientists other than Applicant, accurately assigned peaks to the binding

energy of novel hydrogen having lower energy states, and the Committee has not

shown otherwise.

On pages 79-80 of the Consolidated Appendix, the Committee further incorrectly

states:

> It is observed that applicant has alleged that a "plasma [is] formed at
> I% of the theoretical or prior known voltage requirement with 4,000-7,000
> times less power input power [sic] compared to noncatalyst controls ... ,"
> and that "[t]he light output for power input was increased to 8600 times
> that of the control when argon was added to the hydrogen strontium
> plasma to form catalyst Ar." See p. 4 of a paper authored by applicant
> Mills in attachment 2. The applicant also alleges that a "plasma is formed
> for hydrogen-strontium mixtures at an extremely low voltage of about 2 V."
> See a document co-authored by applicant Mills in attachments 10, 15 and
> 16 as well as p. 23 of the amendment.
>
> These allegations are deemed to be unpersuasive in light of the
> following discussion. Noting that a plasma is a gas consisting of charged
> particles, such as ions and electrons, it is observed that, according to the
> applicant, the energy required to produce a plasma from a neutral

hydrogen atom is allegedly obtained by tapping into its "fractional quantum number energy states" *via* a "non-radiative transition" catalyzed by certain elements. However, as established by the examiner throughout this response, and, especially, in § 9, the applicant has failed to demonstrate that fractional quantum number energy states *even exist.*

The Committee again erroneously relies upon outdated quantum theory to dismiss Applicant's data rather than consider it. The fact remains, Applicant can produce plasma using low voltage when the catalyst is present and no plasma is produced when the catalyst is not present. The Committee does not refute this evidence.

On pages 80-81 of the Consolidated Appendix, the Committee further incorrectly states:

> The applicant has *postulated* the following reaction mechanism scheme to account for plasma formation from hydrogen using strontium (Sr) as a "catalyst":

"188.2 eV + Sr(m) + H[aH/p] —. $Sr^{5\sim}$ + 56 + I-I~~/~p+I)] + [(p+7)^2 — p~ x 13.6 eV $Sr^{5\sim}$ + 56 —' Sr~m) + 188.2 eV
H[aH/p] —+ H[aH/(p+I)] + [(p+7)^2 — p~ x 13.6 eV."

> Thus see attachment 15, equations 5 to 7 on p. 3 of a paper, co-authored by applicant Mills, entitled "Observation of extreme ultraviolet hydrogen emission from incandescently heated hydrogen gas with strontium that produced an anomalous optically measured power balance."

> According to p. 2 of the cited paper, "p" in the above equation is an integer greater than 1. Therefore, a *starting reactant* in the first equation above is a *"hydrino atom,* "H[aH/p]. This indicates that the applicant *assumes the existence of a "hydrino atom"* in order to show that a plasma is allegedly obtained from hydrogen under rather unlikely conditions. Clearly, this forms no logical argument to establish the existence of a "hydrino atom" from the formation of a plasma.

> Moreover, applicant's postulated mechanism requires the formation of $Sr^{5\sim}$ which represents a clearly *unconventional* oxidation state of strontium whose normal oxidation state is $Sr^{2\sim}$ given that it is an alkaline earth metal from Group IIA of the Periodic table.

> Furthermore, in view of applicant's own statement that strontium allegedly functions as a "catalyst" (which, by definition, does not itself undergo a chemical change), it is then *contradictory* to show a reaction in

which strontium participates as a reactant in that it undergoes conversion from a neutral element (Sr) to an ion ($Sr^{5\sim}$).

Additionally, no compelling scientific reason is presented as to why precisely 188.2 eV of energy are required as an input energy in the first equation of applicant's postulated reaction mechanism other than applicant's desire to find a "match." It is noted that applicant's reaction mechanism is not consistent with achieving a true resonance condition since there appears to be no integer value of "p" consistent with the requirement that the energy for converting Sr "catalyst" to the oxidized form $Sr^{5\sim}$ is resonant with, or is the same as, the energy released in the transition between the "H[aH/p]" and "H[a~/(p+l)]" states of the "hydrino atom."

Applicant will try once again to correct a fundamental misunderstanding by the Committee. From 15. R. Mills, J. Dong, Y. Lu, "Observation of Extreme Ultraviolet Hydrogen Emission from Incandescently Heated Hydrogen Gas with Certain Catalysts", Int. J. Hydrogen Energy, Vol. 25, (2000), pp. 919-943, p=1 is implicit in the preceding text:

The catalysis of hydrogen involves the nonradiative transfer of energy from atomic hydrogen to a catalyst which may then release the transferred energy by radiative and nonradiative mechanisms. As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (1-2).

Inorganic Catalysts

A catalytic system is provided by the ionization of t electrons from an atom to a continuum energy level such that the sum of the ionization energies of the t electrons is approximately $m \, X \, 27.2 \, eV$ where m is an integer. One such catalytic system involves strontium. The first through the fifth ionization energies of strontium are $5.69484 \, eV$, $11.03013 \, eV$, $42.89 \, eV$, $57 \, eV$, and $71.6 \, eV$, respectively [14]. The ionization reaction of Sr to Sr^{5+}, ($t = 5$), then, has a net enthalpy of reaction of $188.2 \, eV$, which is equivalent to $m = 7$ in Eq. (3).

$$188.2 \, eV + Sr(m) + H\left[\frac{a_H}{p}\right] \rightarrow Sr^{5+} + 5e^- + H\left[\frac{a_H}{(p+7)}\right] + [(p+7)^2 - p^2]X13.6 \, eV \qquad (5)$$

$$Sr^{5+} + 5e^- \rightarrow Sr(m) + 188.2 \, eV \qquad (6)$$

And, the overall reaction is

$$H\left[\frac{a_H}{p}\right] \rightarrow H\left[\frac{a_H}{(p+7)}\right] + [(p+7)^2 - p^2]X13.6\ eV \tag{7}$$

A chemically formed hydrogen plasma, extraordinarily-high optical power balance, and states of strontium beyond 2+ are observed experimentally confirming the catalyst reaction as reported in the papers:

52. R. Mills and M. Nansteel, P. Ray, "Bright Hydrogen-Light Source due to a Resonant Energy Transfer with Strontium and Argon Ions", New Journal of Physics, Vol. 4, (2002), pp. 70.1-70.28.
20. R. Mills and M. Nansteel, P. Ray, "Argon-Hydrogen-Strontium Discharge Light Source", IEEE Transactions on Plasma Science, Vol. 30, No. 2, (2002), pp. 639-653.
16. R. Mills, M. Nansteel, and P. Ray, "Excessively Bright Hydrogen-Strontium Plasma Light Source Due to Energy Resonance of Strontium with Hydrogen", J. of Plasma Physics, Vol. 69, (2003), pp. 131-158.
15. R. Mills, J. Dong, Y. Lu, "Observation of Extreme Ultraviolet Hydrogen Emission from Incandescently Heated Hydrogen Gas with Certain Catalysts", Int. J. Hydrogen Energy, Vol. 25, (2000), pp. 919-943.

The energy of the reaction of Sr to Sr5+ of 188.2 eV matches the catalyst criterion of an integer multiple of 27.2 eV as stated in the paper at Eq. (3):

Mills predicts that certain atoms or ions serve as catalysts to release energy from hydrogen to produce an increased binding energy hydrogen atom called a *hydrino atom* having a binding energy of

$$Binding\ Energy = \frac{13.6\ eV}{n^2} \tag{1}$$

where

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p} \qquad (2)$$

and p is an integer greater than 1, designated as $H\left[\frac{a_H}{p}\right]$ where a_H is the radius of the hydrogen

atom. Hydrinos are predicted to form by reacting an ordinary hydrogen atom with a catalyst having a net enthalpy of reaction of about

$$m \cdot 27.2 \; eV \qquad (3)$$

where m is an integer. This catalysis releases energy from the hydrogen atom with a commensurate decrease in size of the hydrogen atom, $r_n = na_H$. For example, the catalysis of $H(n=1)$ to $H(n=1/2)$ releases $40.8 \; eV$, and the hydrogen radius decreases from a_H to $\frac{1}{2}a_H$.

The excited energy states of atomic hydrogen are also given by Eq. (1) except that

$$n = 1, 2, 3, ... \qquad (4)$$

The $n = 1$ state is the "ground" state for "pure" photon transitions (the $n = 1$ state can absorb a photon and go to an excited electronic state, but it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state is possible by a nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. These lower-energy states have fractional quantum numbers, $n = \frac{1}{integer}$. Processes that occur without photons and that require collisions are common. For example, the exothermic chemical reaction of $H + H$ to form H_2 does not occur with the emission of a photon. Rather, the reaction requires a collision with a third body, M, to remove the bond energy-$H + H + M \rightarrow H_2 + M^*$ [12]. The third body distributes the energy from the exothermic reaction, and the end result is the H_2 molecule and an increase in the temperature of the system. Some commercial phosphors are based on nonradiative energy transfer involving multipole coupling. For example, the strong absorption strength of Sb^{3+} ions along with the efficient nonradiative transfer of excitation from Sb^{3+} to Mn^{2+}, are responsible for the strong manganese luminescence from phosphors containing these ions [13]. Similarly, the $n = 1$ state of hydrogen and the $n = \frac{1}{integer}$ states of hydrogen are nonradiative, but a transition between two nonradiative states is possible via a nonradiative energy transfer, say $n = 1$ to $n = 1/2$. In these cases, during the transition the electron couples to another electron transition, electron transfer reaction, or inelastic scattering reaction which can absorb the exact amount of energy that must be removed from the hydrogen atom. Thus, a catalyst provides a net positive enthalpy of reaction of

$m \cdot 27.2 \, eV$ (i.e. it absorbs $m \cdot 27.2 \, eV$ where m is an integer). Certain atoms or ions serve as catalysts which resonantly accept energy from hydrogen atoms and release the energy to the surroundings to effect electronic transitions to fractional quantum energy levels.

The catalysis of hydrogen involves the nonradiative transfer of energy from atomic hydrogen to a catalyst which may then release the transferred energy by radiative and nonradiative mechanisms. As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (1-2).

Inorganic Catalysts

A catalytic system is provided by the ionization of t electrons from an atom to a continuum energy level such that the sum of the ionization energies of the t electrons is approximately $m \, X \, 27.2 \, eV$ where m is an integer. One such catalytic system involves strontium. The first through the fifth ionization energies of strontium are $5.69484 \, eV$, $11.03013 \, eV$, $42.89 \, eV$, $57 \, eV$, and $71.6 \, eV$, respectively [14]. The ionization reaction of Sr to Sr^{5+}, ($t = 5$), then, has a net enthalpy of reaction of $188.2 \, eV$, which is equivalent to $m = 7$ in Eq. (3).

$$188.2 \, eV + Sr(m) + H\left[\frac{a_H}{p}\right] \rightarrow Sr^{5+} + 5e^- + H\left[\frac{a_H}{(p+7)}\right] + [(p+7)^2 - p^2]X13.6 \, eV \qquad (5)$$

$$Sr^{5+} + 5e^- \rightarrow Sr(m) + 188.2 \, eV \qquad (6)$$

And, the overall reaction is

$$H\left[\frac{a_H}{p}\right] \rightarrow H\left[\frac{a_H}{(p+7)}\right] + [(p+7)^2 - p^2]X13.6 \, eV \qquad (7)$$

On pages 81-82 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant has stated that "The mechanism of EUV emission ... is predicted by a solution of the Schrodinger equation with a non-radiative boundary constraint put forward by Mills." See p. 2 of the cited paper. This statement is clearly incorrect since the applicant uses a classical wave equation, ~ç the Schrodinger equation, as his starting point as discussed by the examiner in § 5 of this response. Since the use of a classical wave

equation to describe a quantum phenomena, such as the radiation emitted from an atom, is incorrect (cf.~ 5), it is not surprising that applicant reaches an incorrect conclusion regarding "extreme ultraviolet hydrogen emission" from hydrogen gas.

Instead of nitpicking the experimental evidence, Applicant requests that the Committee fairly consider it. Applicant has submitted extensive experimental evidence from third-party scientists who have provided conclusions regarding the extreme ultraviolet hydrogen emission, which the Committee simply ignores. Furthermore, in the published articles of record, Applicant shows in detail how his conclusions were reached, and the Committee's mere conclusions to the contrary fail to show otherwise.

On page 81 of the Consolidated Appendix, the Committee further incorrectly states:

> It is concluded that applicant's reaction mechanism represents a scientifically improper scheme which is indicative of applicant's expectations of the way things *ought* to be rather than a scheme in which conformity to *logic* and *correct scientific facts* dictate the outcome. In light of the above, any allegation of forming a plasma by using energies given by transitions between non-existent energy states of a "hydrino atom" powered by a 2 V source lacks scientific credibility.

The fact that a plasma is produced in the presence of catalyst and no catalyst is produced in the absence of catalyst is not refuted by the Committee. Mere conclusions that this reaction mechanism lacks "scientific credibility" is not evidence. Applicant again requests that the Committee fairly consider the evidence of record.

Further, Applicant finds it ironic the Committee's arguments regarding "conformity to logic." Applicant's modern theory is based on classical laws and logic. In contrast, outdated quantum theory violates classical laws and is associated with the illogical fantasy world of multiple dimensions and other anomolies.

On pages 81-82 of the Consolidated Appendix, the Committee further incorrectly states:

> It is observed that the source of the statements cited above from attachments 2, 10, 15 and 16 *emanates from the applicant.* In particular, the allegation of plasma formation at input voltage thousands of times lower than conventionally used voltage is found in papers authored by applicant and his coworkers *none of which appear to have been evaluated for scientific accuracy.* See, e.g., p. 28 of attachment 2 where the papers

are said to have been either "submitted" or "in press."

Applicant also submitted a Rule 132 Declaration signed by him. Under the current law, the Committee must consider that experimental evidence, even though it has not yet been peer reviewed.

On page 82 of the Consolidated Appendix, the Committee further incorrectly argues:

> Moreover, experiments appear to have been conducted at the "Institut für Niedertemperatur Plasmaphysik e.V." by Conrads with funding apparently provided by applicant's company, BlackLight Power Inc.. (See Dow Jones Newswires October 6, 1999.) [Footnote omitted.]

This argument is absurd. No commercial laboratory on the planet works for free, or they would be out of business. Just because Applicant paid for the laboratory's services has no bearing on the credibility of the evidence. Applicant requests that the Committee fairly consider the evidence instead of hiding behind flimsy excuses.

On pages 82-83 of the Consolidated Appendix, the Committee further erroneously argues:

> In the reference by applicant (Mills et al.) entitled "Comparison of Excessive Balmer a Line Broadening of Glow Discharge and Microwave Hydrogen Plasmas with Certain Catalysts" that was cited in the information disclosure statement filed on 7/1/7/2002 in U.S. Application Serial No. 09/669,877 (hereinafter referred to as 'Mills et al. "Comparison of Excessive Balmer a Line Broadening" document'), applicant asserts that the broadening of the hydrogen Balmer a line in microwave discharge plasma of a mixture containing predominantly argon and small amounts of hydrogen can be explained by a radiative transfer mechanism involving the species providing a net enthalpy of a multiple of 27.2 eV and atomic hydrogen (see p. 3 and 5 of Mills et al. "Comparison of Excessive Balmer a Line Broadening' document). However, conventional alternative theories can explain the broadening of the Ha lines in the microwave discharge plasma of the Ar/H mixture as evidenced by Luque et al. "Experimental research into the influence of ion dynamics when measuring the electron density from the Stark broadening of the Ha and H~ lines", J. Phys. B: At. Mol. Opt. Phys. 36 (2003) pp. 1573-1584.
>
> Luque et al. carried out an analogous microwave discharge plasma experimental setup (see Figure 1 of Luque et al.) involving Ar gas where H was present in a trace amount. Luque et al. explained that under their operating conditions, the whole broadening attained by the profiles of the

Balmer Ha line is the result of two Lorentzian broadenings, the Stark (oh) and van der Waals (u½,) ones and two Gaussian broadenings, the Doppler (o~) and the instrumental (w_1) ones (see p.1580 of Luque et al.). It appears in the Mills et al. "Comparison of Excessive Balmer a Line Broadening" document, applicant has not taken into account broadening of the line profile by the two Lorentzian broadenings in their microwave discharge plasma experiment involving the Ar/H mixture. Applicant state on pages 7 and 8 of the Mills et al. "Comparison of Excessive Balmer a Line Broadening" document that only a Gaussian profile was used to fit the line profile of the Balmer a line. It appears that applicant disregarded significant contributions to the line broadening due to dynamic Stark broadening (one of the components of Lorentzian broadening) in interpreting his data.

Luque et al. was able to fully account for the line broadening of the Balmer Ha line in a gas mixture comprising Ar and H only with two Lorentzian components and two Gaussian components as stated above. These components fully account for the broadening of the Balmer Ha line due to proper analysis of the electron density and ion dynamics in the system by Luque et al. There is no need to use a resonant energy transfer mechanism to explain the broadening of the Balmer Ha line when an alternative conventional explanation offered by Luque fully accounts for the broadening of the Ha line in a mixture of H_2/Ar in a microwave discharge experiment.

Applicant has incorrectly assumed that the Doppler effect (the Gaussian component) is the main cause of the line broadening in microwave discharge plasmas as stated in Mills et al. "Comparison of Excessive Balmer a Line Broadening' document. Furthermore, applicant incorrectly states that there was no electric field present in the microwaves plasma and therefore the results of the Balmer a line broadening cannot explained by Stark broadening (see page 12 of Mills et al. "Comparison of Excessive Balmer a Line Broadening' document). The microwave plasma contains an internal electric field due to the ions and electrons present in the plasma and this internal electric field causes dynamic Stark broadening of the Balmer H a line. Applicant's incorrect assertion regarding the mechanism of this line broadening in the Balmer H a line is enough to disqualify all of applicant's arguments based on anomalous or excessive line broadening in microwave plasmas due to a resonance transfer (r-t) mechanism.

It is crucial to note Luque did not observe Ar catalyzing hydrogen atoms in his microwave discharge experiments (that would be evidenced by anomalous line broadening according to applicant's arguments) in direct contrast to applicant's microwave discharge experiments with Ar and hydrogen and applicant does not deny that Luque did not observe

anomalous line broadening in his microwave experiments containing Ar and hydrogen. It is irrelevant that Luque et al. did not use an Evenson cavity as the Evenson cavity is just an alternative source of microwave discharge provided to the gas.

From these arguments, it is apparent that the Committee misunderstands Stark broadening, thus undermining its own position. A broadening of 0.16 nm corresponds to 10 eV. The observation of such large broadening with a catalyst (Ar+) and hydrogen in a microwave cell confirms Applicant's result. Such broadening can not be explained by the Stark effect or other conventional explanations. Specifically, from 49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355:

> Stark broadening of hydrogen lines in plasmas can not be measured at low electron densities using conventional emission or absorption spectroscopy because it is hidden by Doppler broadening. In the case of the Lyman α line, the Stark width exceeds the Doppler width only at $n_e > 10^{17} \ cm^{-3}$ for temperatures of about $10^4 \ K$ [34]. Gigosos and Cardenoso [35] give the observed Balmer α Stark broadening for plasmas of hydrogen with helium or argon as a function of the electron temperature and density. For example, the Stark broadening of the Balmer α line recorded on a $H + He^+$ plasma is only 0.033 nm with $T_e = 20,000 \ K$ and $n_e = 1.4 \ X \ 10^{14} \ cm^{-3}$.
>
> The relationship between the Stark broadening $\Delta\lambda_S$ of the Balmer β line in nm, the electron density n_e in m^{-3}, and the electron temperature T_e in K is
>
> $$\log n_e = C_0 + C_1 \log(\Delta\lambda_S) + C_2 [\log(\Delta\lambda_S)]^2 + C_3 \log(T_e) \qquad (5)$$
>
> where $C_0 = 22.578$, $C_1 = 1.478$, $C_2 = -0.144$, and $C_3 = 0.1265$ [36]. From Eq. (5), to get a Stark broadening of only 0.1 nm with $T_e = 9000 \ K$, an electron density of about $n_e \sim 3 \ X \ 10^{15} \ cm^{-3}$ is required, compared to that of the argon-hydrogen plasma of $< 10^9 \ cm^{-3}$ determined using a compensated Langmuir probe, over six orders of magnitude less. Regional maxima in electron densities that could give rise to Stark broadening was eliminated as a possibility. The measured electron densities did not exceed $10^9 \ cm^{-3}$, and the axial variation was weak, showing less than a factor of two change throughout the brightest region of the plasma. The high mass

diffusivity of all of the species present made it unlikely that a large density gradient existed anywhere in the plasma at steady state. This result was also evident by the good fit to a Gaussian profile recorded on the argon-hydrogen plasma rather than a Voigt profile as shown in Figure 10. In addition, the line broadening for Balmer β, γ, and δ was comparable to that of Balmer α; whereas, an absence of broadening beyond the instrument width was observed for the lines of argon or helium species such as the 667.73 nm and 591.2 nm Ar I lines and 667.816 nm and 587.56 nm He I lines. Thus, the Stark broadening was also insignificant.

A linear Stark effect arises from an applied electric field that splits the energy level with principal quantum number n into $(2n-1)$ equidistant sublevels. The magnitude of this effect given by Videnovic et al. [8] is about $2 \, X \, 10^{-2} \, nm/kV \cdot cm^{-1}$. No appreciable applied electric field was present in our study; thus, the linear Stark effect should be negligible. The absence of broadening of the noble gas lines and the hydrogen lines of the controls confirmed the absence of a strong electric field. No charged resonator cavity surfaces were present since the plasmas was contained in a quartz tube with the cavity external to the tube. A microwave E-mode field does exist in the Evenson cavity that is a function of the reflected power [37-38], and the catalysis reaction is dependent on this field as discussed previously [39]. However, there is no cathode fall region and the magnitude of the microwave field is comparably much less than that found in the cathode fall region of a glow discharge cell.

The broadening is unequivocally Doppler broadening as discussed in Reference Nos. 49 and 37. The microwave-field broadening reported in the Committee's cited Luque et al. paper is <u>six orders of magnitude too low</u> to account for the broadening reported by Applicant (e.g. Ref. #49).

Specifically, the broadening reported in the Committee's cited reference URL: http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf is 0.37 cm-1 with no field and 3.7 cm-1 with the application of the microwave field. The energies corresponding to these widths are $4.5 \, X \, 10^{-5} \, eV$ and $4.5 \, X \, 10^{-4} \, eV$, respectively, which is absolutely negligible compared to the >10 eV hot H found in rt-plasmas. The microwave field can not explain Applicant's results. The Committee's alternative explanation is off by <u>six orders of magnitude</u>. Thus, the Stark and microwave field effects originally argued by the Committee are eliminated as the basis of the broadening observed in Applicant's cells.

Applicant also objects to the way the Committee unfairly ignores Applicant's experimental evidence, while it then tries to pass off a competitor's experiments as

representing those of Applicant. Applicant requests that the Committee stop with the excuses and start to fairly consider the experimental evidence of record.

Applicant further points out that the broadening in Applicant's work was observed in an Evenson microwave cell, which is one of the best known cavities for producing ions required in the case of the hydrino reaction since Ar+ and He+ are the catalyst. The broadening was found to be dependent on time and flow rate that are indicative of a chemical reaction. In contrast, Luque's experiments did not use an Evenson cavity **and were not performed with variation in the flow rate or run for long duration**. Thus, the conditions used by Luque were not representative of the present invention and thus any reliance on his experiments is misplaced.

From its statements above, it is apparent that the Committee is changing its story and wrongly attributing it to a misunderstanding on the part of Applicant. The Committee's shifting position is made clear from its prior statement, in which it incorrectly argued that broadening was observed and could be attributed to conventional explanations:

> Applicant points out that the reasons for Balmer line broadening are discussed in many articles, and that the observed broadening is in excess in what can be expected from known sources thereof. This is not persuasive because broadening may be caused by various means including those taken into account by applicant, and those not taken into account. In the enclosed article by Luggenholscher, et. al. , broadening equivalent to that found by applicant, shown in figure 1, is accounted for by conventionally known explanations such as the Stark effect. The enclosed article by Luque et. al. accounts for Halpha broadening using two Lorentzian mechanisms (Stark and Van der Waals) and two Gaussian mechanisms (Doppler and instrumental).

For these reasons, Applicant requests that the Committee look past failed quantum theory and the dubious experiments of Applicant's competitors and begin to fairly consider the experimental evidence of record.

On page 84 of the Consolidated Appendix, the Committee further incorrectly states:

> Other plasma physicists (Cvetanovic et al., J. Appl. Phys. (2005) and Jovicevic et al., J. Appl. Phys. (2004)) have also provided alternative explanations for the line broadening in the Balmer H alpha line in

applicant's plasma data (Mills et al., J. Appl. Phys. 92, 7008 (2002)). The Cvetanovic et al. studies of the excessive broadening of the hydrogen Balmer alpha line in abnormal glow discharge experiments (Cvetanovic et al., J. Appl. Phys. (2005)) contradict applicant's resonance transfer model to explain the excessive line broadening in glow discharge plasmas (Mills et al., IEEE Transactions on Plasma Science, Vol. 31, No. 3 (2003), pp. 338-335). Cvetanovic et al. states that "[f]or the analysis of line shapes and for the study of the Hx axial intensity decays, the collision model is adequate. . . The presence of large excessive Ha line broadening in pure hydrogen and several experimental results, such as the importance of the direction of observation with respect to the electric field and exponential decay of excessive broadened Balmer line intensity in the negative glow, are in contradiction to the resonance transfer model" Cvetanovic et al. at p. 0300032-7.

Cvetanovic has already been fully addressed by Applicant, without an adequate response from the Committee. As previously stated, Applicant finds the Committee's views on this article extremely troubling, though hardly surprising, since it appears to be a thinly veiled hatchet-job intended to discredit Applicant. Cvetanovic et. al. propose that the energy required to selectively heat atomic hydrogen to extraordinary temperatures comes from the field acceleration of ionic species. The paper **J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted** demonstrates that no model of that type is viable. Broadening existed throughout the plasma, and not only in the region of high fields. In fact, it was found that the nature of the broadening does not correlate to field strength whatsoever. All predictions that orientation of the observer relative to the field will impact the nature of the observed broadening were disproved. For example, observation parallel to the field should yield broad lines that are red or blue shifted, and not symmetric, as a function of the orientation of the observer relative to the cathode. The results were always symmetrical. Also, there is every reason to suggest that the magnitude of the broadening observed perpendicular to the direction of the field should be less than that parallel to the field. It was independent of the viewing direction. Philips et al. provide a data set, remarkably thorough relative to that of previously published work, that shows the shape of the Balmer lines perpendicular to the field, parallel to the field and in regions with no field are remarkably similar under many conditions. This data also

makes all forms of the "field acceleration" models of broadening untenable.

The Cvetanovic article contains some data consistent with the statements made above. For example, in Figure 4 of that article there is data that shows that the broadening of the Ha peak is independent of the orientation of observation relative to the field direction.

Unfortunately, although the data agrees with that collected and reported by Philips et al., the text of the article contains some clear misrepresentations. Specifically, the data regarding the fit of Figure 4c (but notably not that of Figures 4a and 4b) is missing. It also appears to the careful reader that Fig. 4c was printed in a larger format than Figures 4a and 4b, and hence gives the appearance to the casual reader that the broadening in Figure 4c is larger than that of figures 4a and 4b. In fact, the broadening of Figure 4c is virtually identical to that measured for Figures 4a and 4b.

Perhaps the authors of the aforementioned paper did not want readers to have direct access to the data. Indeed, the data contradicts statements made in the Abstract:

> Large excessive Balmer alpha line broadening in pure hydrogen and its dependence upon the direction of observation with respect to the electric field is in contradiction to the resonance transfer model, proposed by Mills et al. in several publications (see, e.g., IEEE Trans. Plasma Sci. 31, 338 2003.)

Putting such a statement in the Abstract is a clear indication of the intent of the authors, i.e. to disprove the RT model despite the data to the contrary. Indeed, since the data they present shows that there is no dependence of line broadening upon the direction of observation with respect to the electric fields, the above statement in the abstract is false. The attack on Applicant's paper thus has the appearance of malice.

The sense of malicious mischief is increased because of additional directly false statements, such as this one from the conclusions:

> The presence of large excessive Ha line broadening in pure hydrogen and several experimental results, such as the importance of the direction of observation with respect to the electric field and exponential decay of excessive broadened Balmer line intensity in the negative glow, are in contradiction to the resonance transfer model.

Not only is the data contained in the paper in direct contradiction to the statement

regarding "direction of observation," there is in fact not a shred of data presented that refutes any of the predictions of CQM. It is unfortunate that these statements were even published, but then to be touted by the Committee is outrageous.

On pages 84-85 of the Consolidated Appendix, the Committee further incorrectly states:

> Despite applicant's assertions that the collisional model would not explain the Balmer H alpha line broadenings in the microwave-induced discharge (MID) experiments since there is no electric field used in MID experiments, this point is irrelevant because glow discharge and microwave induced discharge experiments are entirely two different plasma systems with different ion dynamics and cannot be directly compared.

The Committee's argument is simply wrong and irrelevant besides. As discussed previously and herein, the Balmar line broadening was found to be dependent on time and flow rate, which are indicative of a chemical reaction, not other mechanisms like Doppler-broadening. Applicant repeats his request that the Committee start fairly considering the experimental evidence of record and stop introducing irrelevant excuses for not doing so.

On page 85 of the Consolidated Appendix, the Committee further incorrectly states:

> Nevertheless, Cvetanovic et al. notes at page 033302-2 that "in two other experiments performed simultaneously in two different laboratories, no excessive broadening is detected in MIDs" followed by footnote 14 to Jovicevic et al. "Excessive Balmer line broadening in microwave-induced discharges," Journal of Applied Physics 95, 24 (2004).

> The abstract of the Jovicevic et al. paper states "[r]esults of a hydrogen Balmer line-shape study on microwave-induced plasma discharges operated with pure hydrogen and with argon-hydrogen or helium-hydrogen mixtures are reported. Plasma is generated in a rectangular or coaxial microwave cavity in two separate experiments. In both cases, the emission profiles of the Balmer lines did not show excessive broadening as reported by Mills et al. J. Appl. Phys. 92, 7008 (2002)]." Identical to applicant's microwave induced discharge experiments, **Jovicevic et at. also use an Evenson cavity.** Jovicevic et al. at p. 25. Jovicevic et al. also point out on page 25 of the paper that earlier studies of excessive Balmer line broadening in Ne/Hb Kr/H_2, and **Xe/H_2 mixtures** contradict the data presented in applicant's paper (Mills et

al., <u>J. Appl. Phys</u>. 92, 7008 (2002)). **As stated in the Jovicevic et al. paper, the experimental conditions were kept as close as possible to the conditions in applicant's experiments reported in the <u>Journal of Applied Physics</u> 2002 paper cited above.**

Once again, the Committee is unable to keep its facts straight. Here, the Committee claims that Jovicevic's experiments used conditions "as close as possible" to Applicant's—admitting that conditions were not the same. Yet, elsewhere, the Committee claims, incorrectly, that the experiments were "identical."

In any case, in making these arguments, the Committee completely flips patent law on its head. Instead of considering Applicant's experimental evidence as it is required to do, the Committee erroneously claims that competitors conducted Applicant's experiments "as close as possible" and then uses that so-called "evidence" as an excuse for having ignored Applicant's evidence. This is but another example of the loose standards set by the Committee in its haphazard approach to patent examination. Once again, Applicant requests that the Committee cease these tactics and begin to fairly consider Applicant's experimental evidence.

Furthermore, as stated previously, it is not clear that Jovicevic et al. failed to observe the phenomenon of fast H in microwave plasmas. In S. Jovicevic, M. Ivkovic, N. Konjevic, S. Popovic, L. Vuskovic, J. Appl. Phys. 95, 24 (2004), the authors state that it impossible to form fast H in microwave plasmas since there is no field to which the ions can couple, but at the conclusion they hedge: "In Ar-H2 discharges, a limited broadening in the wings of the lines coupled be attributed to less than 0.01% fast hydrogen with kinetic energy less than 10 eV". This is very significant given that the electrons heat the atoms and the electron temperature is typically less than 1 eV in these plasmas.

Applicant further notes that Jovicevic et al. used pulsed operation. Others using the same apparatus in continuous operation, as in the case of Applicant's work and following Applicant's direction regarding the dependence on operating conditions and long duration operation, have reproduced Applicant's results:

44. **A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced**

**Concepts Phase I, May 1-November 30, 2002,
http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.p
df.**

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel performed verification studies as visiting researchers at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of extraordinarily broadened atomic hydrogen lines, population inversion, lower-energy hydrogen lines, and excess power measured by water bath calorimetry were replicated. The application of the energetic hydrogen to propulsion was studied.

Specifically, the data supporting hydrinos was replicated. See

i.) BlackLight Process Theory (pp. 10-12) which gives the theoretical energy levels for hydrinos and the catalytic reaction to form hydrinos,

ii.) Unique Hydrogen Line Broadening in Low Pressure Microwave Water Plasmas (pp. 25-27, particularly Fig. 21) which shows that in the same microwave cavity driven at the same power, the temperature of the hydrogen atoms in the microwave plasma where the hydrino reaction was active was 50 times that of the control based on the spectroscopic line widths,

iii.) Inversion of the Line Intensities in Hydrogen Balmer Series (pp. 27-28, particularly Fig. 22) which shows for the first time in 40 years of intensive worldwide research that atomic hydrogen population inversion was achieved in a steady state plasma and supports the high power released from the reaction of hydrogen to form hydrinos,

iv.) Novel Vacuum Ultraviolet (VUV) Vibration Spectra of Hydrogen Mixture Plasmas (pp. 28-29, particularly Fig. 23) which shows a novel vibrational series of lines in a helium-hydrogen plasmas at energies higher than any known vibrational series and it identically matches the theoretical prediction of 2 squared times the corresponding vibration of the ordinary hydrogen species, and

v.) Water Bath Calorimetry Experiments Showing Increased Heat Generation (pp. 29-30, particularly Fig. 25) that shows that with exactly the same system and same input power, the heating of the water reservoir absolutely measured to 1% accuracy was equivalent to 55 to 62 W with the catalyst-hydrogen mixture compared to 40 W in the control without the possibility of the reaction to form hydrinos.

42. **R. L. Mills, P. C. Ray, R. M. Mayo, M. Nansteel, B. Dhandapani, J. Phillips, "Spectroscopic Study of Unique Line Broadening and Inversion in Low Pressure Microwave Generated Water Plasmas", J. Plasma Phys., in press.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. It was demonstrated that low pressure (~0.2 Torr) water vapor

plasmas generated in a 10 mm ID quartz tube with an Evenson microwave cavity show at least two features which are not explained by conventional plasma models. First, significant (> 2.5 Å) hydrogen Balmer α line broadening was recorded, of constant width, up to 5 cm from the microwave coupler. Only hydrogen, and not oxygen, showed significant line broadening. This feature, observed previously in hydrogen-containing mixed gas plasmas generated with high voltage DC and RF discharges was explained by some researchers to result from acceleration of hydrogen ions near the cathode. This explanation cannot apply to the line broadening observed in the (electrodeless) microwave plasmas generated in this work, particularly at distances as great as 5 cm from the microwave coupler. Second, dramatic inversion of the line intensities of both the Lyman and Balmer series, again, at distances up to 5 cm from the coupler were observed. The dramatic line inversion suggests the existence of a hitherto unknown source of pumping of the optical power in plasmas. Finally, it is notable that other aspects of the plasma including the OH^{*} rotational temperature and low electron concentrations are quite typical of plasmas of this type.

On pages 85-86 of the Consolidated Appendix, the Committee further incorrectly states:

Applicant's interpretation of his plasma data is also inconsistent with his own theory. According to applicant's theory of hydrino formation using a hydrogen catalyst acting as an energy hole (see applicant's book, R. Mills; The Grand Unified Theory of Classical Quantum Mechanics, Blacklight Power, Inc., Cranbury, 2000, pp. 147-152), an atom can serve as a hydrogen catalyst if the atom is capable of providing a net enthalpy of reaction of approximately m x 27.2 eV. It is noted that on pages 150-151 of applicant's book (GUT, 2000 edition), multiple atoms can be involved in the catalytic reaction to form a hydrino atom. Id. Since the first ionization potential of an H atom is 13.6 eV, two H atoms would clearly give the required enthalpy of mx 27.2 eV where m ~1 in this instance to catalyze the formation of a hydrino atom from an H atom in the plasma.

Therefore, according to applicant's theory there should be excessive line broadening in the a Balmer line in applicant's plasma data in experiments involving pure hydrogen alone in the plasma. Instead, there is an absence of excessive line broadening in the a Balmer line in plasmas containing only hydrogen gas (see for example Figure 8 in Mills et al., Comparison of Excessive Balmer a Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow-Discharge Hydrogen Plasmas with Certain Catalysts," IEEE Transactions on Plasma Science, Vol. 31, No. 3, (2003), pp. 338-335).

The Examiner's point is further supported by the following

statements made by applicant in the same paper (p. 346, Mills et al., IEEE
Transactions on Plasma Science, Vol. 31, No. 3, **(2003)**, pp. 338-335):

> "In our microwave hydrogen plasma, no such strong filed
> exits. However, the conditions for RT plasmas are met Since
> the ionization energy of hydrogen is 13.6 eV, two hydrogen
> atoms can provide a net enthalpy equal to the potential
> energy of the hydrogen atom, 27.2 eV - the necessary
> resonance energy for a third hydrogen atom."

The Committee's baseless conclusions are simply wrong. Applicant did report a
broadening effect with hydrogen alone, although much less than that observed with He+ or
Ar+ catalysts. This was expected and is reported in the cited paper [49. R. L. Mills, P. Ray,
B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively
and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with
Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 3, (2003), pp. 338-
355.]:

The hydrogen atom energy in plasmas of hydrogen mixed with argon or helium were
about 50-100 times that observed for the control plasmas such as hydrogen mixed with
xenon or hydrogen alone. Even so, the observed ≈ 4 eV energy of the latter plasmas was
still well above the resolution capability of the instrument, and surprisingly it was appreciably
above that expected based on the electron temperature of 1-2 eV. The observation of an
elevated hydrogen atom energy for pure hydrogen plasmas and mixtures containing
hydrogen with the unusual absence of an elevated energy of any other gas present has been
observed before. For example, using a GEC RF cell Radovanov et al. [12] observed that the
structure of the H_α line emission from a pure H_2 discharge showed a slow component with
an average energy of 0.2 eV and a broadened component of 8.0 eV. Very high energies
have also been observed. Hydrogen line broadening corresponding to 123 eV has been
observed with hydrogen plasmas maintained in a GEC RF cell [11]. Extraordinary line
broadening near the cathode corresponding to fast H with >300 eV has only been observed
in the case of discharges of hydrogen or in hydrogen mixtures. This phenomenon is not
observed in discharges of pure noble gases [8, 11, 29-32]. In the case of production of fast
H, the intensity may be low due to efficient collisional energy exchange with dissociative

excitation of molecular hydrogen [33]. In a glow discharge fast H is formed and excited predominantly near the electrode surfaces. The emission from fast H formed at the cathode is also not expected to extend significantly into the bulk of an H_2 discharge because of quenching of H($n = 3$) by collisions with H_2 [12]. Again, this unusual effect was attributed to electric field acceleration of positive hydrogen ions in the cathode fall region.

In Applicant's microwave hydrogen plasma, no such strong field exists. But, the conditions for an rt-plasmas are met. Since the ionization energy of hydrogen is $13.6\ eV$, two hydrogen atoms can provide a net enthalpy equal to the potential energy of the hydrogen atom, 27.2 eV—the necessary resonance energy, for a third hydrogen atom. On this basis, the unusual observation of the H energy slightly above the electron temperature is expected. The effect is expected to be more pronounced at higher greater hydrogen concentrations such as those produced near or on the cathode in RF and glow discharge cells.

This result was also confirmed by Dr. Phillips and reported in a recent paper:

105. J. Phillips, C-K Chen, K. Akhtar, B. Dhandapani, R. Mills, "Evidence of Catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", Journal of Applied Physics, submitted.

On pages 86-87 of the Consolidated Appendix, the Committee further incorrectly states:

> The Examiner recommends Doppler-free laser spectroscopy as it would ultimately clarify the longstanding puzzle regarding the origin of excessive broadening in hydrogen lines. It is unscientific to make an unsupported statement that the Doppler-free laser spectroscopic line width would be negligible in comparison to the observed broadening, since such measurement has never been actually made in the entire history of hydrogen line broadening anomaly. If and only if it turns out that the Doppler-free (i.e., homogenous) line width is within the conventionally known natural line width can one conclusively conclude that the observed broadening is inhomogeneous (Doppler). However, it may well turn out that the Doppler-free line width is effectively as broad as the observed line width, e.g., in the form of plasma satellites or microwave satellites (Blochinzew effect). The Doppler-free technique would be able to cancel out the Doppler effect, thereby measuring only the intrinsic/homogeneous broadening (e.g., natural broadening, Stark broadening, both static and dynamic, AC Stark effect, microwave effects, etc.).

The Committee's recommendation regarding Doppler-free laser spectroscopy is not well taken. **It is unscientific to make an unsupported statement that the Doppler-free laser spectroscopic line width would be negligible in comparison to the observed broadening, since such measurement has never been actually made in the entire history of hydrogen line broadening anomaly.** If and only if it turns out that the Doppler-free (i.e., homogenous) line width is within the conventionally known natural line width can one conclude that the observed broadening is inhomogeneous (Doppler). However, it may well turn out that the Doppler-free line width is effectively as broad as the observed line width, e.g., in the form of plasma satellites or microwave satellites (Blochinzew effect). Nevertheless, such Doppler-free laser spectroscopy is not necessary since Applicant's experimental data conclusively ruled out all of the Committee's other explanations for the broadening based on fields. If the Committee would just fairly consider this experimental evidence, it would no doubt be forced to admit that its alleged alternative explanations are unacceptable and should be withdrawn.

On page 87 of the Consolidated Appendix, the Committee further incorrectly states:

> As another case in point of independent third party spectroscopic data that can be explained by conventional science without the need to use applicant's scientifically implausible theory of the hydrino atom, applicant's attention is directed to the document titled "Hydrocatalysis Technical Assessment, Prepared for Pacificorp, prepared by Technology Insights, dated August 2, 1996", submitted by applicant on 7/17/2002 in U.S. Application Serial No. 09/669,877. According to the document on page **5,** the applicant of the present application is the founder of Hydrocatalysis Power Corporation (HPC) now known as Blacklight Power, Inc. Pages 20-21 of the document states that spectral data taken from the reference S. Labov and S. Bowyer, "Spectral Observations of the Extreme Ultraviolet Background", The Astrophysics Journal, 371, 810 (1991), were evaluated by HPC for indications of hydrino. HPC assigned peaks in the wavelength region of 80 to 650 A to hydrino transitions. As shown in Table 4-1 on page 21 of the document, the HPC assignments contradict the alternative assignments made by the authors of the paper.

The Committee again fails to recognize that the explanation given by Labov and Bowyer is not credible based on discussions by the authors themselves. From #28 R.

Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322:

B. Identification of Lower-Energy Hydrogen by Soft X-rays from Dark Interstellar Medium

a. Dark Matter

The Universe is predominantly comprised of hydrogen and a small amount of helium. These elements exist in interstellar regions of space, and they are expected to comprise the majority of interstellar matter. However, the observed constant angular velocity of many galaxies as the distance from the luminous galactic center increases can only be accounted for by the existence of nonluminous weakly interacting matter, dark matter. Dark matter exists at the cold fringes of galaxies and in cold interstellar space. It may account for the majority of the universal mass.

The identity of dark matter has been a cosmological mystery. Postulated assignments include t neutrinos, but a detailed search for signature emissions has yielded nil [49]. The search for signatures by the Cryogenic Dark Matter Search (CDMS) developed to detect theorized Weakly Interacting Massive Particles (WIMPs) has similarly yielded nil [50-51]. WIMP theory's main competitor known as MACHO theory which assigns the dark matter to Massive Compact Halo Objects (MACHOs) which rather than elusive subatomic particles comprises ordinary baryonic matter in the form of burned-out dark stars, stray planets, and other large, heavy, but dark objects that must be ubiquitous throughout the universe. However, MACHO theory has also recently been ruled out based on lack of evidence of these dark objects observable by the brief ellipses caused by them moving in front of distant stars. Only a few such objects have been observed after exhaustively searching for over five years [50, 52].

It is anticipated that the emission spectrum of the extreme ultraviolet background of interstellar matter possesses the spectral signature of dark matter. Labov and Bowyer designed a grazing incidence spectrometer to measure and record the diffuse extreme ultraviolet background [53]. The instrument was carried aboard a sounding rocket, and data were obtained between $80\ \mathring{A}$ and $650\ \mathring{A}$ (data points approximately every $1.5\ \mathring{A}$). Several lines including an intense $635\ \mathring{A}$ emission associated with dark matter were observed [53] which has considerable astrophysical importance as indicated by the authors:

"Regardless of the origin, the $635\ \mathring{A}$ emission observed could be a major source of ionization. Reynolds (1983, 1984, 1985) has shown that diffuse $H\alpha$ emission is ubiquitous throughout the Galaxy, and widespread sources of flux shortward of $912\ \mathring{A}$ are required. Pulsar dispersion

measures (Reynolds 1989) indicate a high scale height for the associated ionized material. Since the path length for radiation shortward of $912\ \mathring{A}$ is low, this implies that the ionizing source must also have a large scale height and be widespread. Transient heating appears unlikely, and the steady state ionization rate is more than can be provided by cosmic rays, the soft X-ray background, B stars, or hot white dwarfs (Reynolds 1986; Brushweiler & Cheng 1988). Sciama (1990) and Salucci & Sciama (1990) have argued that a variety of observations can be explained by the presence of dark matter in the galaxy which decays with the emission of radiation below $912\ \mathring{A}$.

The flux of $635\ \mathring{A}$ radiation required to produce hydrogen ionization is given by $F = \zeta_H\ /\ \sigma_\lambda = 4.3\ X\ 10^4\ \zeta_{-13}\ photons\ cm^{-2}s^{-1}$, where ζ_{-13} is the ionizing rate in units of $10^{-13}s^{-1}$ per H atom. Reynolds (1986) estimates that in the immediate vicinity of the Sun, a steady state ionizing rate of ζ_{-13} between 0.4 and 3.0 is required. To produce this range of ionization, the $635\ \mathring{A}$ intensity we observe would have to be distributed over 7% - 54% of the sky."

The first soft X-ray background was detected and reported [54] about 25 years ago. Quite naturally, it was assumed that these soft X-ray emissions were from ionized atoms within hot gases. Labov and Bowyer also interpreted the data as emissions from hot gases. However, the authors left the door open for some other interpretation with the following statement from their introduction:

"It is now generally believed that this diffuse soft X-ray background is produced by a high-temperature component of the interstellar medium. However, evidence of the thermal nature of this emission is indirect in that it is based not on observations of line emission, but on indirect evidence that no plausible non-thermal mechanism has been suggested which does not conflict with some component of the observational evidence."

The authors also state that "if this interpretation is correct, gas at several temperatures is present." Specifically, emissions were attributed to gases in three ranges: 5.5 < log T < 5.7; log T = 6; 6.6 < log T < 6.8.

The explanation proposed herein of the observed dark interstellar medium spectrum hinges on the possibility of energy states below the $n = 1$ state, as given by Eqs. (2a) and (3). A number of experimental observations discussed in the Introduction section lead to the conclusion that atomic hydrogen can exist in fractional quantum states that are at lower energies than the traditional "ground" ($n = 1$) state. The existence of fractional quantum states of hydrogen atoms explains the spectral observations of the extreme ultraviolet background emission from interstellar space [53], which may characterize dark matter as demonstrated in Table 3. (In these cases, a hydrogen atom in a fractional

quantum state, $H(n_i)$, collides, for example, with a $n = \frac{1}{2}$ hydrogen atom,

$H\left(\frac{1}{2}\right)$, and the result is an even lower-energy hydrogen atom, $H(n_f)$, and

$H\left(\frac{1}{2}\right)$ is ionized.

$$H(n_i) + H\left(\frac{1}{2}\right) \rightarrow H(n_f) + H^+ + e^- + photon \qquad (55)$$
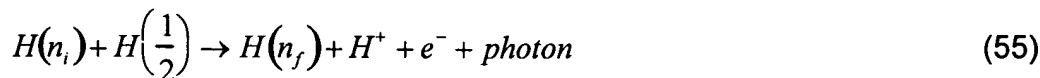
The energy released, as a photon, is the difference between the energies of the initial and final states given by Eqs. (2a) and (3) minus the ionization energy of $H\left(\frac{1}{2}\right)$, $54.4\ eV$.

Thus, lower-energy transitions of the type,

$$\Delta E = \left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) X 13.6\ eV - 54.4\ eV \quad n = 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \text{ and } n_i > n_f \qquad (56)$$

induced by a disproportionation reaction with $H\left[\frac{a_H}{2}\right]$ ought to occur. The wavelength is related to ΔE by

$$\lambda\ (in\ \mathring{A}) = \frac{1.240\ X\ 10^4}{\Delta E(in\ eV)} \qquad (57)$$

The energies and wavelengths of several of these proposed transitions are shown in Table 2. Note that the lower energy transitions are in the soft X-ray region.

b. The Data And Its Interpretation

In their analysis of the data, Labov and Bowyer [53] established several tests to separate emission features from the background. There were seven features (peaks) that passed their criteria. The wavelengths and other aspects of these peaks are shown in Table 3. Peaks 2 and 5 were interpreted by Labov and Bowyer as instrumental second-order images of peaks 4 and 7, respectively. Peak 3, the strongest feature, is clearly a helium resonance line: $He(1s^1 2p^1 \rightarrow 1s^2)$. At issue here, is the interpretation of peaks 1, 4, 6, and 7. It is proposed that peaks 4, 6, and 7 arise from the $\frac{1}{3} \rightarrow \frac{1}{4}$, $\frac{1}{4} \rightarrow \frac{1}{5}$, and $\frac{1}{6} \rightarrow \frac{1}{7}$ hydrogen atoms transitions given by Eq. (55). It is also proposed that peak 1 arises from inelastic helium scattering of peak 4. That is, the $\frac{1}{3} \rightarrow \frac{1}{4}$ transition yields a $40.8\ eV$ photon ($303.9\ \mathring{A}$). Conspicuously absent is the $256\ \mathring{A}$ ($48.3\ eV$) line of He II which eliminates the assignment of the majority of the $303\ \mathring{A}$ line to the He II transition. When this photon strikes $He\ (1s^2)$, $21.2\ eV$ is absorbed in the excitation to $He\ (1s^1 2p^1)$. This leaves a $19.6\ eV$ photon ($632.6\ \mathring{A}$),

peak 1. For these four peaks, the agreement between the predicted values (Table 2) and the experimental values (Table 3) is remarkable.

One argument against this new interpretation of the data is that the transition $\frac{1}{5} \to \frac{1}{6}$ is missing—predicted at 130.2 $\mathring{A}$ by Eqs. (56-57). This missing peak cannot be explained into existence, but a reasonable rationale can be provided for why it might be missing from these data. The data obtained by Labov and Bowyer are outstanding when the region of the spectrum, the time allotted for data collection, and the logistics are considered. Nonetheless, it is clear that the signal-to-noise ratio is low and that considerable effort had to be expended to differentiate emission features from the background. This particular peak, $\frac{1}{5} \to \frac{1}{6}$, is likely to be only slightly stronger than the $\frac{1}{6} \to \frac{1}{7}$ peak (the intensities, Table 3, appear to decrease as n decreases), which has low intensity. Labov and Bowyer provided their data (wavelength, count, count error, background, and background error). The counts minus background values for the region of interest, $130.2 \pm 5\,\mathring{A}$, are shown in Table 4 (the confidence limits for the wavelength of about $\pm 5\,\mathring{A}$ are the single-side 1 confidence levels and include both the uncertainties in the fitting procedure and uncertainties in the wavelength calibration). Note that the largest peak (count – background) is at 129.64 $\mathring{A}$ and has a $counts - background = 8.72$. The $counts - background$ for the strongest signal of the other hydrino transitions are: $n = 1/3$ to $n = 1/4$, 20.05; $n = 1/4$ to $n = 1/5$, 11.36; $n = 1/6$ to $n = 1/7$, 10.40. Thus, there is fair agreement with the wavelength and the strength of the signal. This, of course, does not mean that there is a peak at 130.2 $\mathring{A}$. However, it is not unreasonable to conclude that a spectrum with a better signal-to-noise ratio might uncover the missing peak. With the assignment of the $\frac{1}{5} \to \frac{1}{6}$ transition, all of the hydrogen transitions $\frac{1}{3} \to \frac{1}{4}$, $\frac{1}{4} \to \frac{1}{5}$, $\frac{1}{5} \to \frac{1}{6}$, and $\frac{1}{6} \to \frac{1}{7}$ are observed over the recorded spectral range, and the 632.6 Å peak is identified.

On pages 87-88 of the Appendix the Committee further errs in stating that:

Page 21 of the document also states that Bowyer (an astrophysicist and author of the astrophysics journal paper cited above) disputed the HPC interpretation of the data and that the paper on the FIPC interpretation submitted to the Astrophysical Letters and Communications was not accepted for publication. The document also states on page 21 that the low energy hydrogen concept and its implications regarding data interpretation has not received general review or acceptance by the astrophysics community. Thus, applicant's assertions regarding the

existence of hydrino based on observations of radiation spectra from space, i.e., astrophysical data, have not been accepted by the astrophysics community as evidenced by the document submitted by applicant on 7/17/2002 since a more credible scientific alternative exists to explain the spectral data.

Once again, the explanation given by Labov and Bowyer is not credible as discussed above in this response. The data matches hydrinos. The data is now published in a peer reviewed journal: 28. R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322. The assignment to hydrino has further been validated by the identification of hydrino lines from the claimed Invention. Several peer-reviewed articles have been published that directly show and assign the hydrino spectra lines:

67. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.

50. R. L. Mills, P. Ray, J. Dong, M. Nansteel, B. Dhandapani, J. He, "Spectral Emission of Fractional-Principal-Quantum-Energy-Level Atomic and Molecular Hydrogen", Vibrational Spectroscopy, Vol. 31, No. 2, (2003), pp. 195-213.

33. R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.

29. R. Mills, P. Ray, "Vibrational Spectral Emission of Fractional-Principal-Quantum-Energy-Level Hydrogen Molecular Ion", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 533-564.

28. R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322.

Assignments to known species and contaminants were investigated and ruled out. For example, extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel emission lines were observed with energies of $q \cdot 13.6 \, eV$, $q = 1,2,3,7,9,11.$ or $q \cdot 13.6 \, eV$, $q = 4,6,8$ less $21.2 \, eV$

corresponding to inelastic scattering of these photons by helium atoms due to excitation

of $He \, (1s^2)$ to $He \, (1s^1 2p^1)$. These strong emissions are not found in any single gas

plasma, and cannot be assigned to the known emission of any species of the single

gases studied such as H, H^-, H_2, H_2^+, H_3^+, He, He_2^*, and He^+, known species of the

mixture such as He_2^+, HeH^+, HeH, HHe_2^+, and HHe_n^+ and He_n, or possible contaminants

as given in Ref. 67.

J. Phys. D is a top-tiered physics journal. The spectra were extensively peer

reviewed. The publication unequivocally assigns the lines to hydrino as shown explicitly

in journal article 67:

> The elimination of known explanations indicate a new result. Since
> the novel peaks were only observed with helium and hydrogen present,
> new hydrogen, helium, or helium-hydrogen species are possibilities. It is
> well known that empirically the excited energy states of atomic hydrogen
> are given by Rydberg equation (Eq. (2a) for $n > 1$ in Eq. (2b)).

$$E_n = -\frac{e^2}{n^2 8\pi\varepsilon_o a_H} = -\frac{13.598 \, eV}{n^2}$$ (2a)

$$n = 1,2,3,...$$ (2b)

> The $n = 1$ state is the "ground" state for "pure" photon transitions (i.e. the
> $n = 1$ state can absorb a photon and go to an excited electronic state, but
> it cannot release a photon and go to a lower-energy electronic state).
> However, an electron transition from the ground state to a lower-energy
> state may be possible by a resonant nonradiative energy transfer such as
> multipole coupling or a resonant collision mechanism. Processes such as
> hydrogen molecular bond formation that occur without photons and that
> require collisions are common [47]. Also, some commercial phosphors
> are based on resonant nonradiative energy transfer involving multipole
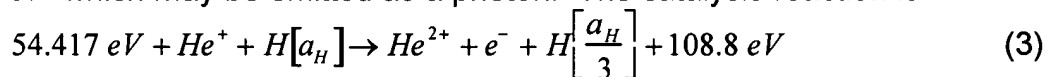> coupling [48].
> We propose that atomic hydrogen may undergo a catalytic reaction
> with certain atoms and ions such as He^+ which singly or multiply ionize at
> integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \, eV$
> wherein m is an integer. The theory was given previously [49]. The
> reaction involves a nonradiative energy transfer to form a hydrogen atom
> that is lower in energy than unreacted atomic hydrogen that corresponds
> to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ..., \frac{1}{p}; \quad p \text{ is an integer}; \quad p \leq 137$$ (2c)

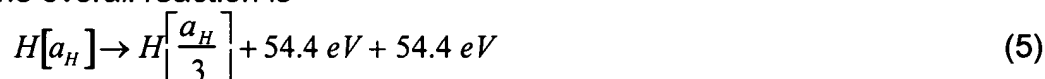> replaces the well known parameter $n =$ integer in the Rydberg equation for
> hydrogen excited states. Thus, the Rydberg states are extended to lower
> levels as depicted in Figure 9. The $n = 1$ state of hydrogen and the

$n = \dfrac{1}{integer}$ states of hydrogen are nonradiative, but a transition between two nonradiative states is possible via a nonradiative energy transfer, say $n = 1$ to $n = 1/2$. Thus, a catalyst provides a net positive enthalpy of reaction of $m \cdot 27.2 \, eV$ (i.e. it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

The novel peaks fit two empirical relationships. In order of energy, the set comprising the peaks at $91.2 \, nm$, $45.6 \, nm$, $30.4 \, nm$, $13.03 \, nm$, $10.13 \, nm$, and $8.29 \, nm$ correspond to energies of $q \cdot 13.6 \, eV$ where $q = 1,2,3,7,9,11$. In order of energy, the set comprising the peaks at $37.4 \, nm$, $20.5 \, nm$, and $14.15 \, nm$ correspond to energies of $q \cdot 13.6 - 21.21 \, eV$ where $q = 4,6,8$. These lines can be explained as electronic transitions to fractional Rydberg states of atomic hydrogen given by Eqs. (2a) and (2c) wherein the catalytic system involves helium ions because the second ionization energy of helium is $54.417 \, eV$, which is equivalent to $2 \cdot 27.2 \, eV$. In this case, $54.417 \, eV$ is transferred nonradiatively from atomic hydrogen to He^+ which is resonantly ionized. The electron decays to the $n = 1/3$ state with the further release of $54.417 \, eV$ which may be emitted as a photon. The catalysis reaction is
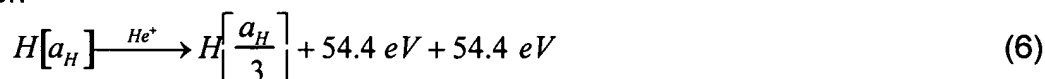
$$54.417 \, eV + He^+ + H[a_H] \rightarrow He^{2+} + e^- + H\left[\frac{a_H}{3}\right] + 108.8 \, eV \qquad (3)$$

$$He^{2+} + e^- \rightarrow He^+ + 54.417 \, eV \qquad (4)$$

And, the overall reaction is

$$H[a_H] \rightarrow H\left[\frac{a_H}{3}\right] + 54.4 \, eV + 54.4 \, eV \qquad (5)$$

Since the products of the catalysis reaction have binding energies of $m \cdot 27.2 \, eV$, they may further serve as catalysts. Thus, further catalytic transitions may occur: $n = \dfrac{1}{3} \rightarrow \dfrac{1}{4}$, $\dfrac{1}{4} \rightarrow \dfrac{1}{5}$, and so on.

Electronic transitions to Rydberg states given by Eqs. (2a) and (2c) catalyzed by the resonant nonradiative transfer of $m \cdot 27.2 \, eV$ would give rise to a series of emission lines of energies $q \cdot 13.6 \, eV$ where q is an integer. It is further proposed that the photons that arise from hydrogen transitions may undergo inelastic helium scattering. That is, the catalytic reaction
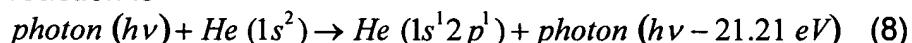
$$H[a_H] \xrightarrow{He^+} H\left[\frac{a_H}{3}\right] + 54.4 \, eV + 54.4 \, eV \qquad (6)$$

yields $54.4 \, eV$ by Eq. (4) and a photon of $54.4 \, eV$ ($22.8 \, nm$). Once emitted, the photon may be absorbed or scattered. When this photon

strikes He $(1s^2)$, 21.2 eV may be absorbed in the excitation to He $(1s^1 2p^1)$. This leaves a 33.19 eV (37.4 nm) photon peak and a 21.21 eV (58.4 nm) photon from He $(1s^1 2p^1)$. Thus, for helium the inelastic scattered peak of 54.4 eV photons from Eq. (3) is given by

$$E = 54.4 \; eV - 21.21 \; eV = 33.19 \; eV \; (37.4 \; nm) \tag{7}$$

A novel peak shown in Figures 2-4 was observed at 37.4 nm. Furthermore, the intensity of the 58.4 nm peak corresponding to the spectra shown in Figure 4 was about 60,000 photons/sec. Thus, the transition He $(1s^2) \rightarrow He$ $(1s^1 2p^1)$ dominated the inelastic scattering of EUV peaks. The general reaction is

$$photon \; (h\nu) + He \; (1s^2) \rightarrow He \; (1s^1 2p^1) + photon \; (h\nu - 21.21 \; eV) \tag{8}$$

The two empirical series may be combined—one directly from Eqs. (2a, 2c) and the other indirectly with Eq. (8). The energies for the novel lines in order of energy are 13.6 eV, 27.2 eV, 40.8 eV, 54.4 eV, 81.6 eV, 95.2 eV, 108.8 eV, 122.4 eV and 149.6 eV. The corresponding peaks are 91.2 nm, 45.6 nm, 30.4 nm, 37.4 nm, 20.5 nm, 13.03 nm, 14.15 nm, 10.13 nm, and 8.29 nm, respectively. Thus, the identified novel lines correspond to energies of $q \cdot 13.6 \; eV$, $q = 1,2,3,7,9,11$. or $q \cdot 13.6 \; eV$, $q = 4,6,8$ less 21.2 eV corresponding to inelastic scattering of these photons by helium atoms due to excitation of He $(1s^2)$ to He $(1s^1 2p^1)$. The values of q observed are consistent with those expected based on Eq. (5) and the subsequent autocatalyzed reactions as discussed previously [50]. The broad satellite peak at 44.2 nm show in Figure 2-4 is consistent with the reaction mechanism of a nonradiative transfer to a catalyst followed by emission. There is remarkable agreement between the data and the proposed transitions to fractional Rydberg states and these lines inelastically scattered by helium according to Eq. (8). All other peaks could be assigned to He I, He II, second order lines, or atomic or molecular hydrogen emission. No known lines of helium or hydrogen explain the $q \cdot 13.6 \; eV$ related set of peaks.

On pages 89-90 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant Mills has submitted a declaration, dated June 8, 2001, which claims that he has allegedly obtained "new emission lines" for hydrogen (paragraph 6 of the declaration), has formed a plasma in a cell with "no high voltage source" (paragraph 10), has "confirmed the resonant nonradiative energy transfer of 3 ~27.2 eV [sic] from atomic hydrogen to atomic potassium," (paragraph 11) and "conclusively show[n] the spectroscopic observation of the predicted H - (1/4) hydride ion"

(paragraph 12). In the declaration, the applicant cites publications, test reports and meetings. Attached to the declaration are two documents co-authored by applicant Mills entitled "Spectral emission of fractional quantum energy levels of atomic hydrogen from a helium-hydrogen plasma and the implications for dark matter" (Paper I) and "Spectroscopic identification of a novel catalytic reaction of potassium and atomic hydrogen and the hydride ion product" (Paper II), respectively. These documents relate to spectral emission from atomic hydrogen and spectroscopic identification of a "novel catalytic reaction."

The declaration is deemed to *lack probative value* both in view of the discussion in the preceding section (~ 24) regarding applicant's spectroscopic and plasma data and further in view of the following observations. Firstly, it is noted that in Paper I above, the applicant's postulated reaction mechanism for the formation of a hydrogen plasma using helium as a catalyst (see equations S to 7 on p. 8 of the paper) is similar to the corresponding mechanism using strontium as a catalyst, barring the use of different energy numbers (eVs) to force a match between the input and output of energy. Since the illogical and scientifically improper nature of applicant's strontium-based reaction mechanism was previously discussed in § 24, the examiner's position as stated there applies equally well against applicant's postulated mechanism in Paper I, especially, with regard to the unconventional oxidation state of $He^{2\sim}$ for helium which is an *inert* element and the applicant's use of an energy input of 54.417 eV in conformance with applicant's expectation of what the reaction mechanism ought to be rather than base it on scientifically justified requirements.

Secondly, it is noted that Paper II above, which deals with extreme ultraviolet emission from incandescently heated hydrogen, is *cumulative* to applicant's information given in attachments 10 and IS which were previously discussed in § 24.

The Committee's circular argument is nonsensical. As a basis for ignoring the experimental evidence of record, the Committee's only argument is that Applicant's explanation is illogical. Applicant has shown in great detail how his modern theory accurately predicts lower energy states and complies with classical laws. Applicant then submitted experimental evidence, which conclusively proves the existence of the lower energy states. Applicant requests the Committee fairly consider the evidence of record.

On page 90 of the Consolidated Appendix, the Committee further incorrectly states:

Thirdly, the interpretation of the "experimental" data obtained by the applicant *hinges crucially* on the existence of *allegedly fractional* integer quantum number energy levels of the electron in the hydrogen atom. Conversely, *it is the applicant's* theory of the "hydrino atom" with fractional integer quantum number energy levels *which predicts* new spectral lines and transitions for atomic hydrogen, the formation of a hitherto unknown species of hydride ion and the generation of plasma under rather unlikely reaction conditions. Thus, see Papers I and II, cited above. The examiner maintains that since such energy levels have not been shown to have any proper scientific or mathematical basis, as objectively established by the examiner in § 9 in this response, any prediction from such an improper theory which leads to an assignment of spectral lines is *clearly devoid* of meaning. In light of this, the figures showing spectra and the tables listing transitions between fractional integer quantum number energy levels lack scientific merit.

The experimental evidence does not merely predict lower energy states, it conclusively shows them to exist, including Applicant's spectral line data that the Committee unfairly dismisses without adequate basis. Of course, Applicant has submitted more than just spectral line data, as discussed fully above in the main body of this Response, which evidence the Committee also unfairly dismisses or ignores altogether.

Furthermore, Applicant has shown above that his modern theory is mathematically sound, based on classical laws, and fully accounts for the lower energy states now experimentally proven, notwithstanding the Committee's erroneous allegations to the contrary. It is the outdated quantum theory to which the Committee so desperately clings that is mathematically flawed and violates classical laws.

On page 90-91 of the Consolidated Appendix, the Committee further incorrectly states:

Furthermore, it would have been a reasonable expectation on the part of one of ordinary skill in the art that the applicant's assignment of "catalytic transitions," such as n 1/2 —÷ 1/3, etc., which are stated by the applicant himself to be *"autocatalytic"* and have a "higher reaction rate than that of the inorganic ion catalyst" (see p. 8 of Paper I) would logically (due to autocatalysis and the lack of a lower bound on 1/p where i/p is the fractional principal quantum number, n, and p = 2, 3, 4, etc.) lead to a cascade of transitions culminating in the collapse of the alleged "hydrino atom." This issue of the stability of the "hydrino atom" and applicant's unpersuasive arguments given in connection with that is discussed in § 7

of this response. This provides yet another reason as to why the applicant's assignment of transitions is without meaning given that the "hydrino atom," if it ever existed, is unstable.

As stated previously, this is not true based on conservation of energy as disclosed in Chapter 5 of R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, January 2000 Edition, BlackLight Power, Inc., Cranbury, New Jersey, distributed by Amazon.com, as well as the earlier versions of Applicant's book, which are incorporated by reference into the subject application.

Applicant never stated or alleged that the hydrino atom implodes. The Committee has it completely backwards. Applicant's theory does not result in the electron contacting the nucleus, whereas the Schrodinger equation cited by the Committee actually requires that the electron must exist in the nucleus part of the time, as discussed above. Overly simplistic arguments such as these only further demonstrate the Committee's improper approach of taking Applicant's teachings out of context and making nonsensical conclusions that actually undermine its own position.

Applicant's teachings clearly state the following:

NEW "GROUND" STATE

Hydrogen atoms can undergo transitions to energy states below the ground state [13.6 eV] until the total potential energy of the proton is converted to relativistically corrected kinetic energy and total energy (the negative of the binding energy). The potential energy V of the electron and the proton separated by the radial distance radius r_1 is,

$$V = \frac{-e^2}{4\pi\varepsilon_o r_1} \tag{5.72}$$

where the radius r_1 is the proton radius given by Eq. (28.1)

$$r_p = 1.3 \times 10^{-15} \, m \tag{5.73}$$

Substitution of Eq.(5.73) into Eq.(5.72) gives the total potential energy V of the electron and the proton

$$V = \frac{-e^2}{4\pi\varepsilon_o r_p} = 1.1 \times 10^6 \, eV \tag{5.74}$$

Thus, Applicant's theory clearly provides limits on how low of an energy state the electron can be taken using Applicant's novel nonradiative transfer of energy from the hydrogen atom. Applicant's theory does not state that the electron catastrophically collapses into the nucleus and the Committee has no basis for making such an absurd

allegation.

On page 91 of the Consolidated Appendix, the Committee further incorrectly states:

> Applicant's alleged observation of "new" emission lines in the spectrum of the hydrogen atom must be weighed against the following facts given in the previously cited state-of-the-art treatise by Bethe and Salpeter (1977), at p. 12, *viz.:*
>
>> "The wave numbers of *many lines* of the spectrum of the hydrogen atom can be measured to an *accuracy of better than one part in a million.* ... After applying corrections for fine structure, etc., [cf. the Dirac equation and the equations of quantum electrodynamics discussed by the examiner in § 17, pp. 38-41] the agreement for a *large number of spectral lines is excellent,* to better than *one part in a million* for the HB."
>
> As evidence, Figures 2 and 3 from pp. 10-11 of Bethe and Salpeter are attached to show that the conventional experimentally obtained lines in the spectrum of the hydrogen atom have been *properly* identified by standard quantum mechanics. It is, therefore, very clear that it is an art-recognized fact that the spectrum of the hydrogen atom has been mapped out thoroughly.
>
> It is noted that the applicant states that his predictions match the "experimental" data to a "remarkable three significant figures" (see paragraph 7 of the declaration). While it is not understood as to what accounts for its being so remarkable, what *is* of significance here is that this degree of "matching" clearly pales in comparison to the predictions of conventional or standard quantum mechanics, as evinced by Bethe and Salpeter's statement cited above, that quantum mechanics has an accuracy of "better than one part in a million." *Hence, standard quantum mechanics is a thousand times more accurate in its predictive power, for the spectral lines of the hydrogen atom, compared* to *applicant's improper theory.* In light of the above discussion, applicant's allegation of novel experimental data, based on his *improper* theory *that predicts hitherto unseen* spectral lines, is clearly without merit.

The "corrections for fine structure" applied by quantum theory is a curve fit. by curve fitting, an exact match can be made. However, such curve fitting has no predictive power, and cannot be used to exclude real-world experimental data and ignore its ramifications. In contrast, Applicant's modern theory is predictive, as in the

case of the lower energy states. The experimental evidence confirmed these lower energy states without curve fitting, thus demonstrating the superiority of Applicant's more advanced, modern theory over flawed, outdated quantum theory.

The fact remains that Applicant's extensive experimental evidence of record conclusively demonstrates the existence of lower energy states and the Committee has not shown otherwise. Citation to Bethe and Salpeter does not directly address the experimental evidence of record and thus carries no evidentiary weight.

On page 92 of the Consolidated Appendix, the Committee further incorrectly states:

> Of particular concern is the fact that the declaration and its attachments contain no independent evidence to confirm applicant's allegations concerning the "hydrino atom" or, synonymously, "lower energy hydrogen". That is, the hallmark of scientifically valid information, viz., information that is *reproducible and verified* has *not* been met in this case. This is all the more significant given that, in the present instance, *applicant's claims violate conventionally well-established ideas of modern science* as established throughout this response. While p. 28 of Paper I cited above refers to the contribution of the Institut für Niedertemperatur Plasmaphysik e.V." in obtaining experimental data on transitions in the hydrino atom, the source providing such data cannot be considered as being independent for the reason stated in § 24 at p. 61.

These statements are inconsistent with the Committee's own explicitly stated standard requiring that Applicant publish his experimental evidence in peer-reviewed journal articles before that evidence would be considered. When Applicant complied with that request and submitted 65 peer-reviewed publications, the Committee now uses the excuse that the experimental evidence is not independent. Applicant requests that the Committee stop this nonsense and fairly consider the experimental evidence of record as it is required to do under the law.

Further, the fact that a claimed invention violates "well established ideas of modern science" is not a legitimate basis for rejecting claims to that invention, especially when those "ideas" have been shown to be fatally flawed. Thus, merely because Applicant's invention violates certain "ideas" is not sufficient grounds to support an enablement and/or utility rejection. All that shows is that Applicant's claimed invention is novel and non-obvious. Thus, the Committee has not met its burden of establishing a

prima facie case of lack of utility or nonenablement.

On pages 92-93 of the Consolidated Appendix, the Committee further incorrectly states:

> It is further observed that there is no indication as to Papers I and II co-authored by applicant Mills have been independently checked for accuracy as opposed to representing applicant's *own* statements of support for his postulated "hydrino atom" and its alleged experimental manifestations.

> The publications, test reports and meetings noted in an attachment to the declaration do not appear to be new and were previously cited by the applicant in the attachments to his amendment in response to the previous office action. These attachments have been discussed at length in this response by the examiner. In the previous sections of this response, the merits of the test reports, alleged by applicant to be "independent," were evaluated and found to be unpersuasive. Thus see 21 and 23.

> Contrary to the apparent impression produced by applicant's citing of as many as 23 meetings, a study of the list of meetings shows that, in reality, the applicant made several different presentations in the same meeting or fewer meetings rather than exhibit his ideas in many different meetings. As an example, note that the 4 meetings (meeting numbers ii to 14) all involved different presentations in the *same* meeting, viz., the 219th American Chemical Society meeting.

> Moreover, the subject matter for meetings 12 to 14 overlap in that they all involve applicant's hydride compounds. Thus his list of 23 meetings drops to 10 distinct meetings.

> It is further observed that at least some of the presentations in the meetings held by the American Chemical Society appear to be "poster presentations." In such presentations, there is no requirement that an audience be present.

These statements merely highlight once again the Committee's willingness to find flimsy excuses to avoid considering the experimental evidence of record. Applicant requests that the Committee stop this nonsensical approach to patent examining, look past weird quantum theory, and fairly consider the experimental evidence of record.

On page 94 of the Consolidated Appendix, the Committee further incorrectly states:

As established in this response by the examiner, the applicant's scientifically and mathematically improper theory and the lack of probative experimental data do not overcome the weight of evidence against the existence of the postulated "hydrino atom."

Once again, the Committee's mere conclusions are not evidence and carry no weight. Applicant has shown his theory to be mathematically correct and fully supported by the experimental evidence of record, which is mostly ignored by the Committee.

On page 94 of the Consolidated Appendix, the Committee further incorrectly states:

Most, if not all, of applicant's experimental data have been certified by applicant himself or coworkers and not by independent third parties. Applicant alleges 51 independent third parties testing in his response (see pages 60-98 in response filed on 5/23/2005 in U.S. Serial No. 09/669,877). An analysis of the list of 51 studies shows that applicant is an author of at least 31 of those studies (see items # 51-49, 47, 46, 43-20, 16, and 7 in which applicant is lead author or coworker).

The studies listed in items 13-15, and 48 are conducted by Phillips who is a coworker as evidenced by items #50 and 51 in which applicant and Phillips are coauthors of those studies.

The study listed in item 8 is conducted by Shaubach who is also a coworker (as evidenced by item #7 in which Shaubach and applicant are coauthors of that study). Thus, at least 36 of the 51 studies are not independent test studies.

There is no requirement in the law that experimental evidence must be independent to be considered, just like there was no valid requirement that Applicant publish his evidence in peer-reviewed journal articles before the Committee would deem it credible and worthy of consideration. But now that Applicant has complied with that improper publication requirement, the Committee finds it necessary to raise yet another improper standard designed to avoid a fair consideration of the record evidence. The time has come for the Committee to stop with all the excuses and move ahead expeditiously with a fair hearing on that evidence.

On page 94 of the Consolidated Appendix, the Committee further incorrectly states:

In the few instances where attempts made by independent third parties to reproduce applicant's data have been unsuccessful. For example, studies conducted by Westinghouse, Brookhaven, and NASA were addressed by the examiner in the previous office actions (see Sections 21 and 22 of the consolidated appendix).

As discussed in detail above, the Committee's unsupported conclusion that independent third party replication was unsuccessful is simply wrong.

On page 94 of the Consolidated Appendix, the Committee further incorrectly states:

Plasma physics and spectroscopists have also disagreed with applicant's interpretation of his own plasma data and data from the interstellar medium (see Section 24, "Applicant's spectroscopic and plasma experimental data are not persuasive).

Whether Applicant's competitors disagree with Applicant are irrelevant. Nevertheless, Applicant has shown in detail throughout this response that all of the "plasma physics and spectroscopists" cited by the Committee either are biased (Dr. Souw), committed fraud (Dr. Rathke) or are simply wrong.

On pages 94-95 of the Consolidated Appendix, the Committee further incorrectly states:

Contrary to applicant's allegations that quantum mechanics has not yielded anything useful and that it is nonsensical and does not describe reality, among the many problems solved by quantum mechanics, the hydrogen atom is one of the few scientific problems that have received extensive theoretical and experimental treatment over many years since the first decade of the twentieth century.

The simple fact is that outdated and weird quantum theory absolutely forbids lower energy states below n=1 for hydrogen and Applicant has presented state-of-the-art experimental evidence that conclusively proves the existence of these lower-energy states. Thus, it is the weird quantum theory that must give way to the modern experimental results, not the experimental results.

On page 95 of the Consolidated Appendix, the Committee further incorrectly states:

From a practical standpoint, the enormously successful impact of quantum mechanics on industry is evidenced by the fact that 30% of the U.S. gross

national product today is based on inventions made by possible by quantum mechanics (Tegmark and Wheeler (2001)).

Again, these statements show that Tegmark and Wheeler make ridiculously grandiose statements regarding quantum theory that have no basis in reality. It is true that technologies have been developed that are based on the phenomenon of quantization. But, it can not be said that these technologies would not exist if it were not for probability wave equations (i.e. the Schrodinger equation). This self grandeur of Wheeler is simply nonsense. According to Wheeler, not only technologies but also the existence of the entire universe is dependent on the human mind, which is absurd. In Wheeler's quantum mechanical view of reality, the existence of a computer, a CD player, or an MRI scanner relies upon the human mind to collapse the quantum wavefunction to make these objects real.[49] The Committee is advised to read the original transistor patent, in which case it will find that it contains NO MENTION OF QUANTUM MECHANICS. It is based purely on empirical material science.

The invention of the transistor was based on phenomenology. The invention of the transistor is covered in Proceedings of the IEEE "Special Issue on the Fiftieth Anniversary of the Transistor", Vol. 86, No. 1, January, (1998). At page 34-36, Shockley's Patent is printed. It is not based on quantum mechanics. It is an engineering description of an amplifier based on properties of semiconductor materials arranged in a particular fashion.

There is no solution of the Schrodinger equation used in solid state physics. The discipline advances empirically and quantum mechanical hand-waving is added after a discovery. Examples include the quantum and integral Hall effects. Then there is the stifling of technology by quantum mechanics. For example, theoreticians violently insisted that high temperature superconductivity could not be possible since it violated BCS theory (incidentally a Noble prize was awarded for the DISCOVERY of high temperature superconductivity and the phenomenon can still not be explained by quantum mechanics theory). The Committee should also note as stated by Weinstein in Section I of this report, that chemists have been impeded by quantum mechanics.

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[49] Reference 53.

Then there is the laser. Stimulated emission started with Einstein as an additional term to empirically fit Planck's blackbody radiator curve. The laser is completely explained by Maxwell's equations using the mere empirical observation of quantized energy levels.

The invention of the laser was based more on classical physics applied to observed quantum phenomenon. The idea of stimulated emission originated in 1917 (ten years before the Schrodinger equation was postulated) when Einstein proposed that Planck's formula for blackbody radiation could be obtained from an ensemble of atoms with quantized energy levels that under went stimulated and as well as spontaneous emission.[50] This idea was used by Schawlow and Townes in an extension of classical microwave resonator cavity theory to propose the extension of MASER techniques to visible wavelengths.[51] Masers were originally described classically given the phenomenon of quantization—not by using the Schrodinger equation.

What is even more devastating to the Committee's argument is that the mere existence of the laser disproves quantum mechanics and the Heisenberg Uncertainty Principle as pointed out by Carver Meade, Gordon and Betty Moore Professor of Engineering and Applied Science at Caltech, Feynman's former student, colleague and collaborator, as well as Silicon Valley's physicist in residence and leading intellectual, who was recently interviewed on this subject:[52]

> Central to Mead's rescue project are a series of discoveries inconsistent
> with the prevailing conceptions of quantum mechanics. One was the
> laser. As late as 1956, Bohr and Von Neumann, the paragons of quantum
> theory, arrived at the Columbia laboratories of Charles Townes, who was
> in the process of describing his invention. With the transistor, the laser is
> one of the most important inventions of the twentieth century. Designed
> into every CD player and long distance telephone connection, lasers today
> are manufactured by the billions. At the heart of laser action is perfect
> alignment of the crests and troughs of myriad waves of light. Their

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[50] Reference 66.

[51] Reference 67.

[52] Reference 68.

location and momentum must be theoretically knowable. But this violates the holiest canon of Copenhagen theory: Heisenberg Uncertainty. Bohr and Von Neumann proved to be true believers in Heisenberg's rule. Both denied that the laser was possible. When Townes showed them one in operation, they retreated artfully.

In Collective Electrodynamics, Mead cites nine other experimental discoveries, from superconductive currents to masers, to Bose-Einstein condensates predicted by Einstein but not demonstrated until 1995. These discoveries of large-scale, coherent quantum phenomena all occurred after Bohr's triumph over Einstein.

Magnetic resonance is also described by Maxwell's equations. In fact, in a recent communication, Applicant was informed by Dr. Samuel Patz who heads the MRI Laboratory at the Brigham & Women's Hospital, Harvard Medical School's top research center, that MRI is taught at Harvard and Massachusetts Institute of Technology as the classical precession of the bulk magnetization vector in a frame rotating at the Larmor frequency due to the application of an applied RF field at the Larmor frequency wherein the bulk magnetization is due to the phenomenon of nuclear spin direction quantization.[53] The Schrodinger equation is not used, and the quantum theory of the nucleus, quantum chromodynamics (QCD), is an utter failure in that it can not predict the existence of the proton and neutron or correctly account for the phenomenon of nuclear spin; whereas, Applicant's theory can. From first principles, Applicant's theory predicts the masses of the proton and neutron and their magnetic moments to within a part per hundred thousand of the observed values in closed form equations containing fundamental constants only.[54]

Simply put, quantum mechanics has failed. It can not explain the most fundamental observations such as the nature of a photon, the electron, the wave-particles duality nature of light and particles (See Section 14 of this Response), the masses of particles, gravity, etc. It has been a complete failure at unification.[55] The

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[53] Reference 69.

[54] Reference 39 at Proton and Neutron section.

[55] Reference 39, Forward and Introduction Sections.

Committee has gone to great lengths to establish that Noble prizes have been award in the pursuit of quantum mechanics. The Committee has been diligent at pointing out celebrities of quantum physics. Notably absent from the list are Newton, Einstein, and Maxwell. It doesn't matter how many theoreticians toil at trying to make quantum mechanics work or what fantasies they will tolerate in order to force it to work if it is based on a *false premise*. That false premise is that physical laws such as Maxwell's equations and Newton's laws with Einstein's special relativity do not apply at the atomic level. Physicists have justified the spookiness and absurd consequences of quantum mechanics on the basis that no theory based on physical laws can explain quantum phenomena, such as quantized nature of light and atomic energy levels and the wave-particle duality. This is absolutely *not true* as shown by Applicant.[56] Classical laws work over 85 orders of magnitude of scale from that of elementary particles to that of the cosmos. Science is not a popularity contest, it is the endless search for the ultimate truth of the workings of the physical universe established by empirical observation (I.E., ESTABLISHED BY DIRECT EXPERIMENTATION). Solipsistic nihilism and self grandeur have no place in science.

And, consider the impact on technology. We could live without quantum mechanics and only accept that empirical result that atomic energy levels are quantized. Quantum mechanics was not even adopted in any serious fashion until well after the seeds were sown for the major technologies cited by the Committee. In contrast, classical laws—Maxwell's equations and Newton's laws—which the Committee argues against by advocating the mutually incompatible quantum mechanics—are ABSOLUTELY INDISPENSABLE FOR MODERN SOCIETY. They are absolutely predictive; whereas, quantum mechanics is NOT.

In contrast to Quantum mechanics, which has never predicted a single technology, Applicant's theory has predicted novel hydrogen chemistry, which is now experimentally confirmed as summarized in Section I of this Response. The match between theoretical predictions and experimental observation are remarkable.

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[56] Reference 39.

Applicant's predicted technology could eclipse the value of those cited by the Committee and could in fact advance them significantly as shown in Applicant's published and soon-to-be published articles .[57]

On page 95 of the Consolidated Appendix, the Committee further incorrectly states:

> In applying quantum mechanics in solving the electronic structure of the hydrogen atom, the results obtained from at least one type of standard procedure for solving the radial Schrodinger equation using a power series expansion for the wavefunction of the electron escapably lead to the conclusion that only positive integer values for n are permissible for the energy levels of the hydrogen atom, not fractional values.

Applicant has shown in great detail above that the Schrodinger equation is flawed, which the Committee admits. The Committee has not shown how the Schrodinger equation forbids factional values, i.e. lower energy states. Nevertheless, Applicant agrees with the Committee that outdated quantum theory forbids lower energy states.

As discussed in this Response, since Applicant's modern theory and extensive experimental evidence of record conclusively prove the existence of the lower energy states, outdated quantum theory should be abandoned.

On page 95 of the Consolidated Appendix, the Committee further incorrectly states:

> In contrast, it appears that the condition that n have fractional values in applicant's theory of the hydrogen atom (see equations (L75c) and (2.2) on pages 20 and 81 of GUT (1999 edition) is but an *ad hoc* statement that does not logically flow from applicant's (Mills's) derivation of the equation for the energy levels of the electron in the hydrogen atom and it may even represent a forced parameterization scheme deliberately structured to produce a desired outcome contrary to the logical flow of mathematics. Hence, it appears that applicant's (Mills's) theory remains essentially unproven for the mathematical and scientific reasons as discussed herein, and does not constitute a proper basis to demonstrate the theoretical existence of the hydrino atom.

Applicant has shown above that his modern theory is mathematically sound and

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[57] References 2 and 3.

obey's classical laws. The Committee's mere conjecture that Applicant's theory "may even represent a forced parameterization" is baseless and carries no weight. In contrast, outdated quantum theory is mathematically flawed and violates classical laws.

On page 95 of the Consolidated Appendix, the Committee further incorrectly states:

> The conventionally accepted theory of the atomic structure of the hydrogen and experiment forbid the existence of the hydrino atom. It is, therefore, deemed sound and proper to hold applicant's invention, which is based on the postulated "hydrino atom" or "one-electron hydrino-like atom having an atomic mass of at least four" and its alleged experimental manifestations, to be unpatentable.

Applicant fully agrees that outdated quantum theory "forbids" lower energy states. In contrast, Applicant's modern theory predicts the lower energy states, which are now experimentally confirmed by the state-of-the-art experimental evidence of record.

The Committee now argues that "experiment" forbids the existence of the hydrino (lower energy states), without citing even one credible experiment. In contrast, the extensive experimental evidence of record confirms the existence of the hydrino and the Committee would be well advised to fairly consider it.